On the Quality of Data Management of Publishers and Printers

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Abstract: The interface between publishers and printers is still under development to include the transmission of entire documents (jobs) and other data from the design stages to the mass production. The productivity of this stage, the publisher/printer interface, is critical in relation to the total cost and quality of the printed products. Some of the total quality aspects of this interface are analysed in this paper. The earlier paper, at the TAGA '95 Conference in Orlando, April 1995, defined the concept of Press Frontend, a combination of receiver, storage and output systems for the printer. With this concept and setting systematic requirements for the product definition, process and resource data, the press frontend may become a strategic force for a competitive commercial printer. The requirements and proposed solutions must be related to the respective economic scale, from big web printing plants to sheet-fed production and the new digital printing alternatives. Similarly, the publisher has his scale of operations which may set limits to the way the products are defined and which data management systems are applied.

Introduction

The transition to digital production and digitally controlled printing is a fact. The publishing concepts and business ideas are changing. Publishing production means sets of pages and final documents which are stored and digitally transmitted to the printing plant [1, 3]. Now that the whole production is digital the **store function** rises to dominance. We need to store at all workstations and we additionally need data management, e.g. databases.

At the same time the compatibility, reliability and fault tolerance of the whole production chain must be redefined [1]. The production pace and the massive file sizes set high requirements for the store, index, check, retrieve, transmit and

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receive functions in the production chain. The direct electronic printing - mostly based on electrophotographic or inkjet printer engines - is setting different standards for the pace of very short but complex print jobs [8]. Fortunately the new data management architectures, particularly the client/server systems offer improved functions for the handling of the massive and complex data flow.

The **production** becomes more efficient, but only if the **automation** is used and the new workflows are not only replicated digital versions of the traditional workflows. In the publishing process where the **time-critical** product, the creative talent, the endless changes and the manual routines (within a work group) coincide the new workflow is an organisational problem and a question of changing attitudes [1, 2, 3, 13, 19]. This explains the wide variation in the productivity observed in the publishing companies.

Both the input and output on a workstation consist of files in various media formats. It is difficult to use visual control for the files and jobs without the physical carriers of the print (films and plates). Just before the full resolution output of the press sheets or signatures on a film, plate or printing cylinder the file sizes reach their maximum of the order of hundreds of Mbytes, or even more.

After the platemaking and printing, the **mechanical** units, i.e. plates and copies, are the relevant components of the product flow (1). The final copies are irreplaceable, and faultless as parts of the final, folded and finished product. Even in the event of some streamlining of the total production chain, such as CTP (computer-to-plate), or direct electronic printing, the products tend to get more complex in these last stages, too, and the production chain is difficult to manage and control [1, 2, 6, 9, 14, 15, 19].

As pointed out in previous studies [1, 2, 3, 4], process mapping, definition and modelling are needed for the design of advanced process **reengineering** and workflow systems. Definition and modelling are needed in the subprocesses and for the **total work flow** in the production chain. The production management systems (PMS) and their models use production data (collected from the subprocesses) and PMS software to include local and global PMS functions, as defined [1, 2, 3, 4, 5, 7, 13]. Such models lead to a more streamlined work flow and systematic production and data management.

Today, the interface between publishers and printers is a formatted file, very often a set of PostScript™ pages. At the same time, publishing and printing are mostly done in separate companies, even if the trend towards electronic printing means a less distinct stage in the short jobs [8].

This paper gives more definitions and argumentation for the concept of Press Frontend [1], a method to describe the **interface** between publishers and printers (cf also Fig.3). Many commercial systems are proposing tools for this problematic set of production stages [15, 16, 25] which are often bottlenecks in the time-critical work flow. They have different starting points such as balancing the parallel output lines, securing and backing up the servers, improving the portability, and automating the film output and plate production.

Publishers and Documents

Today, most publishers recognize the tendency towards a rapid increase in the titles and a similar decrease in the sizes of the edition volumes: less pages per job, smaller target groups and a more complex product. This **complexity** is a result of the structured contents, the rich typographic code, more graphics, image layers, colour, changes and versions. No one seems to care how this trend might influence production resources and data flows.

The system tools simplify the inclusion of all this material in the pages. Some basic choices in the native file coding are decisive: Which file formats and versions function more "vendor neutrally", meaning that they are importable and viewable in the most common page and colour design software packages without any extra trouble in the design stages or in the output.

The problem is very obvious. If the native formats of the text, graphics, page design, document definition, font imaging and transmission protocols are **compatible** there is much less trouble in the daily production. SGML editors are available to produce structured code in connection with the text files and later more complex documents. Many older jobs and documents of a publishing house - e.g. earlier editions of books - may be stored in a file format without any structure coding (SGML) but they can be recoded with some extra effort. SGML is also proposed as the core of structured publishing, e.g. in ref. [25].

Many large job files have been reformatted or converted when major system changes in the production and data management are not compatible with the earlier formats. However, any information source of modern media must use some input code and file format. **SGML** repositories and databases will be the key systems for publishers. Such systems will enable both a large number of titles, editions and versions, and parallel and networked media products [12, 16, 22, 25]. Some new document systems build SGML repositories on object databases [25] to use the hierarchy of the structured documents and to improve their reusability.

Practically no serious attempts have been made to define the product, or to optimize the work flow and job scheduling through the **heterogeneous** multi-platform production facility which is a fact in most publishing companies. The process is understood as routine office work where trouble and confusion are normal. Today, the term heterogeneous means that we may have different basic client platforms (workstations and their operating systems) and different servers with different LAN protocols (e.g. TCP/IP) or network operating systems, NOS [23].

Also the **databases** may be more or less compatible in spite of their query language similarities, e.g. SQL [23]. The data processing and management architecture is functionally decisive, although it is a necessary infrastructure [2, 3, 4] for the wide range of production applications running on the network. The key components are

a) the network operating systems - the market leaders are the Novell NetWare and Microsoft Windows NT and their add-ons.

b) the network and data integration architectures [23] and concepts like the ODBC (Open DB Connectivity) or ODS (Open Data Services), or connectivity and database access software in general.

Some straightforward approaches have been proposed by leading vendors, e.g. the Structured Images (SI) approach [10] which is an object-oriented approach to manipulate **compound raster images** (rather than pages) as a collection of device-independent objects and related image processing functions. The SI objects, or SI components, may be of any convertible data type such as ASCII strings, TIFF images, various graphics or PhotoCD. This system, in fact, **automates** some assembly functions and supports some creative and interactive steps like create, scan, gang-scan, image reuse, retrieve, edit and retouch.

The aim is to separate the original images or other source files from the later production operations. It has advantages in handling and creating **variable** information on "dynamically bound placeholders". Variable information handling is the key prepress operation of many short-run, electronic printing jobs. and similarly in network publishing.

Compared to the SGML approach [12] the SI approach [10] is very different. In the SGML early and accurate structure coding is essential to guarantee an open data presentation for later reuse and product branching. The SI approach [10] brings a more closed but conditionally locked raster image, a "pasteboard", including dynamic placeholders, in the closest possible contact with the original or external media objects. Another system [25] combines the object approach with the SGML repository and the media component manager concepts.

Today, the penetration of the systems based on structured documents is low among the traditional publishers and almost equally low in other applications.

Workflow issues

We may talk about information **source or native formats**, or as the WWW term goes, MIMEs, in which the five format types (text, audio, image, video and application) are divided further into several standard subtypes. MIMEs (the Multipurpose Internet Mail Extensions) were originally developed to include various formats in the e-mail messages. It is therefore not a detailed topology of various data presentations, media or output formats.

The SGML formatting of the logical structure is just one of the factors that add to the complexity - while solving another problem. The SGML code itself, does not increase the file too much but the potential for updating and versionizing certainly does at the end of the prepress chain [12]. There, the page files, including trivial static media items (text and image), may comprise several Mbytes in monochrome and tens of Mbytes in colour [1]. If we take final, designed sets of pages (jobs) they are not only large files but they come from many sources with a number of formats.

These **may (or may not) have** been opened, viewed, checked or edited before being paginated. Part of the items, e.g. images, logotypes or ads may be included later. There is a definite need for methods of **testing complex files** or to ensure - from the beginning - that no trouble-making material is included.

Since the page files include a massive code with a long history the occurrence of faults is self-evident. Many items have been closed, locked or encapsulated relatively early though no check is made of the correctness of the original material in the file or its later use. In many cases there is almost no systematic checking procedure. The main reason for this is the shortage of prepress time but the consequences cause trouble in the output and later stages which are even more time-critical. Automatic file checking is a future need [27].

A number of new workflow products are coming into the market [15, 16, 22] such as the LinoServer from Linotype-Hell, Covalent's Shop System, DS's CIMPAS, the Prodix of SyPress, System 2000 of Grafi-Data and Microstar's CADE. Some of them are **integrated** into the whole prepress system and imposition, while others are separate **tool sets** for production tracking and scheduling, or checking the material and the work flow.

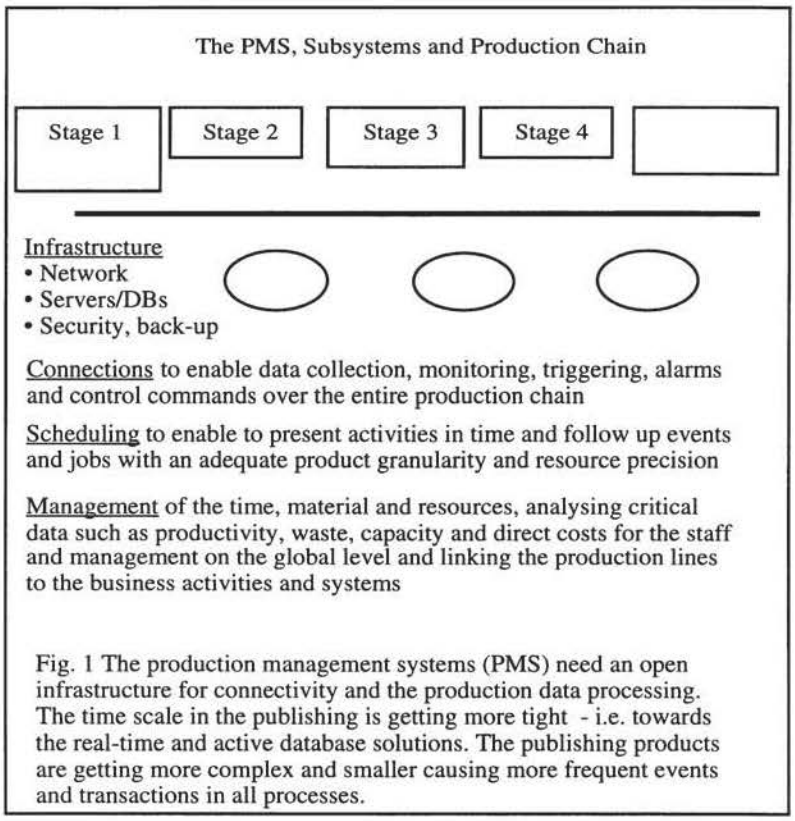

Fig. 1 The production management systems (PMS) need an open infrastructure for connectivity and the production data processing. The time scale in the publishing is getting more tight - i.e. towards the real-time and active database solutions. The publishing products are getting more complex and smaller causing more frequent events and transactions in all processes.

Subsystems do not automatically collect or export any PMS data. Besides, there is only little definition of what the PMS data should include. IFRA recommends the IFRAtrack reported by Enlund and Maeght [28]. No special novelties are needed to save and monitor the PMS data. Today, the normal data management methods, e.g. DBs are the right approaches [1, 2, 3, 4, 6, 13, 23, 25, 26, 28].

What to control in the work flows?

A work flow is a sequence or a network of defined production stages which the product must go through when jobbed in a production line, Fig 1. Production management and the respective systems, the PMS, are pieces of functional and integrated software which take care of the work flow. What is it, actually, that we want to control and manage:

• The global production line, in the first hand, but only as far in the details as the potential savings allow. There is no economic equation for such an estimation. The **granularity** , of the **product components** and the production **resources**, the cost sources, must be defined. This gives the system design the smallest relevant level of detail to be tracked and controlled [4]. No big, monolithic and central system can become a successful product any more.

• **Bottlenecks** in the production, and similarly any necessary overcapacity or redundance, must be analysed and controlled quantitatively. In general, every stage of the production and its subsystem should be defined before the system design. The need for connections in the PMS is a result of such an analysis.

• The **key formats** have to be chosen and defined. Not only the source formats but also any intermediate or portable formats relating to the media components and colour management. The present situation with the font management and page description languages is relatively stable. There are, however, many other key formats. Systems relating to these formats also define production data.

• The check of some intermediate products is crucial. In the press frontend the **imposition result**, the digital signature, controls the job in the output lines. To keep these lines (and the press lines, thereafter) busy and evenly loaded faultless files are needed. Due to the enormous file sizes, the automation of these checks is the only feasible way.

• The **global needs** for the PMS have been discussed earlier. Many connections and a client/server system are required for collecting **multisource data,** needed for the calculation of the productivity, load, cost, waste and quality parameters.

These issues of workflow management are discussed briefly herebelow. As pointed out earlier, in the context of production management system (PMS), the designer has to specify the **granularity level** [1, 3, 4] on which to operate when monitoring the events. In the long chain of publishing production, the last workstations of the prepress, i.e. the page and colour design workstations and their main input the **design-ready files** were proposed as the sufficient level of detail [20]. This arbitrary choice, probabaly, holds on a general level.

From these workstations on the production chain is fairly automated and serial, (transmission, server, imposition, OPI, RIP-recorder, plateline, and press). Therefore coordination and checking of the input (transmission-ready pages) is needed as discussed in recent reports [1, 2, 3, 9, 10, 15]. The research on the TidSim simulator system concentrated on these stages of the production chain [14], i.e. on this area, which is often a **bottleneck.** Each page and their components should be faultless as early as possible [27], in relation to the later

prepress output stages, of which only the type of the recorder, e.g. a PostScript-RIP, is known. Automation in file handling and checking is needed [27].

There may be other producers or production teams who continue (or make subcontracts) with the same source material or with the **intermediate** products like chapters, articles, pictures, textures, backgrounds and tables. In this stage, where the media branch out, the value of structured source formats, e.g. the SGML [12], is really obvious.

Some source formats are more standard than others though the situation is not stable. The intermediate **file formats**, such as TIFF IT [15,17] or Acrobat [18], may be useful to ensure the file quality and the portability, as pointed out by Nordqvist [2]. When properly standardized, they will help with the packaging of prepress jobs for easier transmission, storing, output, tracking and scheduling. These are useful in some instances though the word "portable" should be understood less literally, just like the buzzword "portable colour" [2, 11, 17, 18].

Another process to check is the result of the imposition, the final press sheet assembly, today often a **digital signature** - to use the terms defined [1 and 4]. Here, the big size of these sheets and the respective files is the problem. Thus the check - on a display, hardcopy or proof - should no longer be concerned with any small page items. The page and signature checks reveal quite different problems. The faults come from different processes. Many systematic mistakes can be cured by developing the routines and software. Automation is needed in these proofing cycles, and not only integration of the imposition function [1, 2, 15, 16, 17].

The PMS data may originate in **numerous subsystems,** even if only a single PMS function is concerned. **Multisource** data of this type is typical with global problems such as the use of material, waste control or the global control of the colour quality, i.e. the **colour management** [11]. These problems may require more complex solutions than just the normal data collection format, such as the IFRA Track, as pointed out [1, 3, 4]. They may require more specific (and unfortunately tailored/unique) PMS software modules. The **automation** of data collection in the production lines can be solved in many ways, as shown by the examples from the other industries [23, 24, 25].

Fig. 1 shows how the PMS has to be understood as a client/server application which uses data from all subsystems, i.e. production stages, delivers it back in reports and monitors, controls (or helps the staff with monitored and interactive controls) and supports the complex scheduling of the jobs and resources.

Quality Aspects in Data Stores

The fact that publishing and prepress operations now are digital processes give the **store function** a high priority. We have to be ready to store both various source files and intermediate files, to hold and archive external and support material (images, graphics, masks, templates, grids, textures, backgrounds, layers, forms, logos, clip art) in numerous stages of the production. This is illustrated in Fig 2 . Linked LAN can cross the company borders and offer distributed store and retrieve services with user/client access control.

It is very difficult to use all this digital code unless the data management is adequately dimensioned to support the store, search and retrieval functions. The more information is used and the more structured documents are created, the greater the need to make faultless files as early as possible and to protect them for further processes.

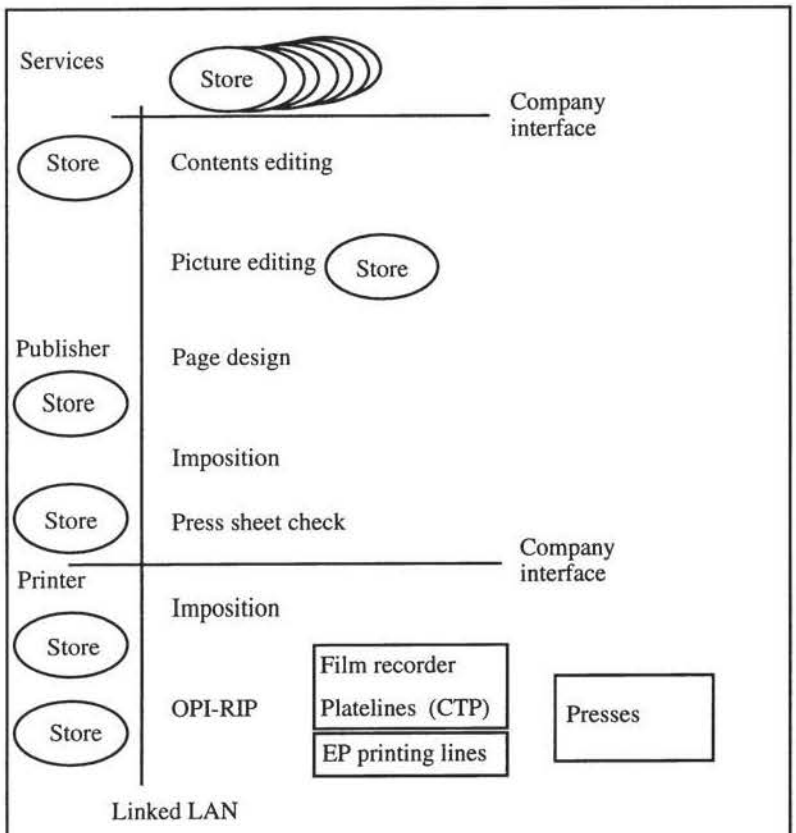

Fig 2. From editing workstations and services (e.g. image banks, ad agencies, WWW/Internet, clip art, news agencies, writers, TV) the publisher-printer production chain needs mass memories or servers for storing product data. Most of the stores are distributed LAN services with access control, security and back-up. The PMS may use the same or separate servers for production databases.

In modern database technologies and client/server systems, the **access** control (to authorize persons to access the stored files), **data security and back-up** are normal requirements. The quality, features and openness of the system products

- both the servers and database (DB) software - are, however, a question of **careful choice**.

The development of the mass store technologies used by the servers is in an early stage of transition. There are several competing server engine concepts [1] such as replication, redundan arrays of disks (RAID), hierarchic stores and various databases, and other data and object store concepts [1, 23, 25]. The cost of the stored data is falling but it is still a major factor. The central data management system products like servers, networks, mass memories, databases and advanced client/server tools [26] are key products frequently tested in the professional magazines. Speed, capacity, compatibility, development functions and other general criteria are used in these tests.

The quality requirements of data management depend on the volume and file complexity. It is very easy to use simple textbases or non-indexing file browsers for office text documents if they do not require any updates or versions, and if the page design is simple [21, 22]. Many types of groupware and office suites include useful communication and adequate filing features.

Indexing the contents and **version tracking** [21] offer wider possibilities in the real file control and production. Structuring the contents helps to build any search functions or tools. There are also special media managers and browsers with advanced multimedia features, especially in the Internet environment [22]. If the network business has to be arranged, digital payment methods and transactions are the highest priorities [22] for information sellers (e.g. publishers) and buyers.

Many **hidden costs** are general symptoms of inadequate data management and sluggish work flow. We can easily list typical and frequent faults and causes of confusion:

- Various items used for article editing are not easy to find in the servers
- Colour and page design uses many shared resources, e.g. distributed software, masks, templates, filters, viewers, drivers and output like (DDCP), or softproofs
- Unidentified or odd files are imported and cannot be opened or used
- Long access times in the sessions due to the loads, bottlenecks and capacities in the servers, DBs and networks
- Tracking failures may cause incomplete documents/jobs and page stacks
- Imposition is done manually instead of signatures based on the valid press configurations of the available presses. Reimposing is easily reflected in the deadlines of the film recording, platemaking or the presses.
- Heavy file loads influence the servers or knock them down completely. The systems and servers vary in this respect and so do the load and workflow.

As pointed out in many instances the use of computer-to-plate (CTP) or direct electronic printing requires heavy reengineering of the work flows and store functions in the Press Frontend of the production chain [1, 5, 7, 8, 9, 13]. The

most frequent mistake is to underestimate the network and server capacities and to accept uncontrolled page files from too many sources.

Press Frontend Systems

As pointed out in the previous papers [1, 4, 7] in which the concept of the Press Frontend was gradually developed and analysed, the printer needs to re-engineer the computer applications properly. In fact, the printing plant needs to launch a capacitive **frontend** to take in digital jobs, to store and proof files, to offer OPI type of services, to accept and include digital ads, to make the imposition (and other job preparations), to queue and control the output on films and plates and finally to arrange and schedule the jobs to reach the presses in due time [1].

For many years the interface was on the print-ready set of colour-separated films - page films or assembled signatures. Now the "digital world" must be accepted in the printing plant. It begins with fluent connectivity to public data networks such as ISDN, and various linked LAN connections with those customer publishers for whom the higher and more reliable LAN capacity is a must. The Press Frontend concept is a major step and investment for any commercial printing plant. It is also one step towards plantwide automation and an improved work flow, the PMS solutions [1, 3, 4, 7].

In Fig. 3 some central activity, quality and workflow issues are connected with the Press Frontend concept. The basic workflow principle may be a server-to-server linked LAN (e.g. TCP/IP) file transfer between the publishers and the printing plant who serve these customer publishers. The publishers can transmit the jobs from their servers in smaller or larger lots.

If the publisher does the **imposition,** the digital signature or sets of them may be proper units. It is self-evident that these units are so large files - independent of the format and sheet size they may have - that the linked or virtual LAN connection must have a high capacity , e.g. about 10 Mbits/sec. The typical file sizes in medium-sized signatures are hundreds of Megabytes, and in colour work several Gigabytes [1]. Data compression may be of help but will not change the overall picture.

Tracking and monitoring the number of pages and signatures in this piece of production chain is most essential as the PMS action needed to inform the successive subsystems and the global PMS. A chain of successive stages may be monitored efficiently, e.g. by **showing the files**, moving them as marked icons over a table of subsystems arranged in rows (parallel lines) and columns (successive stages), as it was done in one of the user interfaces of the production simulator environment TidSim [13].

What the integrated or separate PMS systems may look like in the future is not the topic of this paper. There evidently is a great interest in this topic in most of the publishing technology conferences and workshops as well as in general network and information trading businesses. The central role of the store functions and the respective data management solutions (Networks, DBs, Client/Servers, Repositories, Media Managers and Archiving) make the **Press Frontend** systems and their neighbouring **Prepress Frontend** systems a big market for users systems and applications.

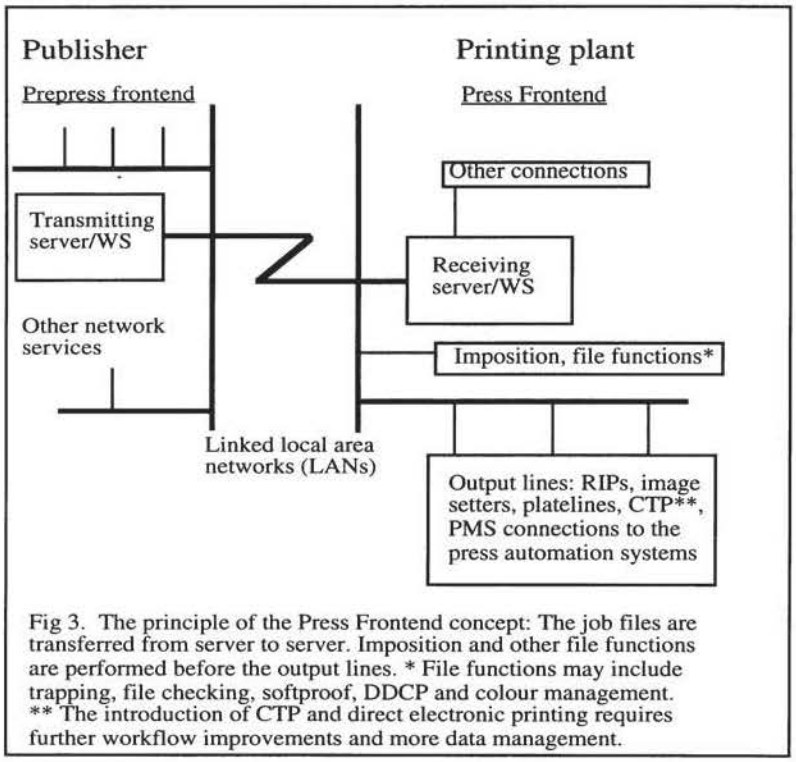

Fig 3. The principle of the Press Frontend concept: The job files are transferred from server to server. Imposition and other file functions are performed before the output lines. * File functions may include trapping, file checking, softproof, DDCP and colour management. ** The introduction of CTP and direct electronic printing requires further workflow improvements and more data management.

Conclusions

Most printing plants have very little experience in starting print jobs from digital file material. They may consider themselves experts in paper handling and electro-mechanical printing presses rather than players in the digital world.

Printing plants have to adapt their production to smaller series of complex and high-quality jobs. They have to develop a new standard of product and production **flexibility**. They have to deliver the highest product and process quality in order to compete in the digital world of many media without any paper or other physical carriers.

The production management systems (PMS) will be the new resources of printing plants. In the publishing processes, workflow and PMS software already have a market for system products. The PMS is much easier to implement in digital prepress and publishing processes. Many automation features must, however, be inbuilt into the PMS data collection, as shown by a few recent examples [24, 25].

In the printing plants, the Press Frontend systems must include and apply modern concepts of data management. Automation of page and signature checking must be shared and distributed among the production lines of the publisher and the Press Frontend. This will enable a smooth work flow and control the output lines which are a natural bottleneck.

It is obvious that the interfaces between the publishers and the printers are digital job files. The more complete the press control and automation systems are and the more the printers use direct electronic printing, the more important it will be to design the preceding stages, the Press Frontend systems with a great care, and to link them to the customer publishers. By delivering adequate flexibility the future printed media can become competitive.

Acknowledgement

Many ideas take time to develop into a certain belief and a concept. To me the Press Frontend was originally a scheme to describe one part of the printer´s production. After a couple of reports [1, 4], for which I must thank both my colleagues and "homebase" - the VTT Information Technology - it seems that this concept is of wider scope. My sincere thanks to Mr Johan Stenberg - my closest discussion partner at KTH - and to Ms Helene Juhola and Ms Asta Bäck at VTT, two colleagues who give me valuable and regular feed-back.

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26. Ed Dowgiallo et alii "Advanced Client/Server Tools: Client-side Confusion" Product Comparison of the Infoworld, 12 June 1995, p. 52.

27. Anon. System descriptions and product documents are available of e.g. two early pagefile checking software packages of Autologic (APS-Preflight) and Ultimate Technographics (Flight Simulator: Impostrip Second Generation).

28. Nils Enlund and Philippe Maeght (IFRA) "A Recommendation for the Interconnection of Production Tracking Systems in Newspaper Production" TAGA/IARIGAI ´95 Conference, Paris, France, 17-20 September 1995.