A PAGE DISPLAY SYSTEM FOR PLATE SCANNER AND TELEPROOFED IMAGES

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ABSTRACT

A page display system, called PAGEVISION, has been developed to give an overview of the production and to aid the platemaker and the pressman in their operations. The page images of a publication under production are received from plate scanners or as teleproofs from the pagination stations and stored in a database. The display gives a global overview of the actual production situation; which plates of a certain page have passed through the plate scanners and which pages have been finished at the editorial pagination stations. In addition to this overview, the system provides detailed page images in colour to help the platemaker to evaluate the plates and the pressman to prepare for printing and evaluate the printed result. This proofing capability is especially important in remote printing, where the pressman does not normally have any hardcopy proofs to rely on. The system is based on a standard local area network and it uses standard PC workstations, which makes customization easy. The system has been tested at a major newspaper printing plant in Finland.

1. INTRODUCTION

Efficient printing production requires that the outputs of the various production stages - pagination, filmmaking, platemaking and printing - are clearly defined and checkable. Some outputs, like paper paste-ups and final prints, are by nature checkable, while others must be processed into a viewable form; digital pages into monitor and paper proofs, separation films into laminated proofs.

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This paper deals primarly with a system for converting the offset printing plates into a colour proof on the monitor, thus making the output also of platemaking viewable and checkable. In addition, the paper devises methods for monitor proofing of digital pages on the prepress side.

Checkable outputs are not enough - the electronic proofs have to be managed in an integrated manner and communicated across the processing stages to allow overview of the production, comparative evaluations and even acceptance procedures. The PAGEVISION system, utilizing image mangement methods earlier developed in our laboratory (see e.g. [Söd,88]), includes such facilities. The page image database, covering the whole production cycle, combined with a visual user interface gives the user insight in the state of the production process at different levels of detail. This support helps to avoid serious errors and to improve the colour print quality.

Page production display systems like PAGEVISION are especially important, when the production stages are geographically separated as in remote printing. Currently, the pressman in a satellite printing plant often lacks any physical proof of what he is printing. In this case, he has only faxed films to go after. Especially in colour printing, this can cause serious errors. Difficult "artistic" colour combinations or unusual spot colours may be interpreted in a wrong way. Colour separation films and plates may even be interchanged. It is almost impossible for the press crew to know if some of the process colours are missing or are wrong.

Currently, commercial plate scanners only control the ink presettings of the press and do not provide any page visualization capabilities. Recently, a viewing simulator system has been presented that uses plate scanner data [Dun, 93]. However, this system does not give a global overview of the state of the production, nor does it provide a link to the prepress side.

2. TYPES OF PAGE INFORMATION HANDLED BY THE SYSTEM

The PAGEVISION system uses information from the pagination stage and from the printing plates.

2.1 Pagination information

The prepress is becoming increasingly digital, which means that the complete page information is available in a digital form at the pagination stations. The problem is how to convert it into a format that can be displayed by the viewing software.

The most straightforward method is to convert the *PostScript file,* generated by the pagination program, into a pixel map image. This method offers arbitrary resolution and therefore a good simulation of the print. Even the screening structure may be visualized. A drawback is that the PostScript interpretation still takes a fairly long time on

standard computers [Söd,91a, pp. 78]. Future developments of PostScript into more editable and displayable forms will make this method increasingly convenient.

Dumping the screens of the pagination programs is a more rapid way to capture the information. However, because of the restrictions of current pagination software, both spatial and colour depth resolution are limited. An additional drawback is that the operator of the pagination station must perform some extra operations.

If the pagination station is a closed, dedicated system of CEPS type without any software capturing capability, the monitor screens can be captured by *digitizing the monitor control signals* [Söd, 91b]. This demands an adaptive frame grabber hosted in a separate microcomputer. This method works with all pagination systems, but its drawbacks are the costs of extra equipment, additional operations for the paginator, and a mediocre image quality.

2.2 Plate Scanner Information

The original function of the plate scanner is to provide data for presetting the ink feed of the printing press in order to speed up the start-up process [Kai, 85]. For this purpose, the scanner computes the printing area on the plate for each inking zone in the press. Especially in newspapers, the plate scanner is an integral part of the modern offset printing technology.

In the PAGEVISION system, the plate scanner gets the additional task of delivering the data for visualizing on a monitor the content of the printing plates. This enables the platemaker to evaluate how the film-plate conversion has succeeded (e.g. dot percentages) and to observe colour register errors that have originated in the manual page assembly or page transmission. An interchange of the colour separations will be seen as false colours on the screen. To the pressman the plate proof gives a visual target for controlling the press.

The resolution of the current plate scanner does not allow to observe the finest spatial details. E.g. standard text is not readable. On the other hand, this is not essential for the press control.

3. THE PAGEVISION ARCHITECTURE

The PAGEVISION system forms an image database from the printing plates passing through the plate scanners and from the digital pages created at the pagination stations in the prepress department. The page images (both broadsheets and tabloids) are stored in the server, retrieved and displayed at the viewing stations. In a newspaper environment, the database typically covers the pages and plates produced during one day. The architecture of the system is described in *Figure 1*.

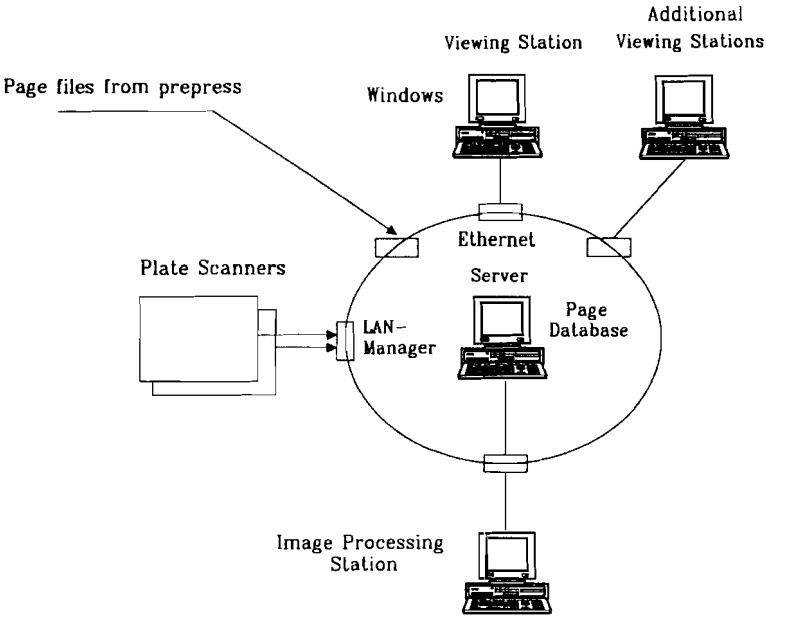

Figure 1. The architecture of the PAGEVISION system.

The page images created at the pagination stations are transferred through the LAN or through telecommunication links. e.g. 64 kbit/s links, as described in the TAGA 91 paper on teleproofing [Söd,91a]. They are stored in the server as RGB or CMYK files. If processing is needed, the images are passed to the image processing station before being stored in the database.

The data flow from the plate scanner is similar: the raw data corresponding to a certain colour separation goes through the server to the image processing station, where the separations are combined into a colour image, which is sent to the image database of the server. The database format is TARGA-CMYK.

The viewing stations keep a copy of the database in their local disk memory to speed up the display. The local database is updated whenever a new page arrives in the database of the server. The local database contains three versions of the page image - CMYK, RGB and low-resolution "thumbnail" RGB. The viewing station calculates the RGB versions from the CMYK plate images for display purposes. The CMYK version is saved, because the dot percentages have to be displayed.

4. THE COMPONENTS OF THE PAGEVISION SYSTEM

PAGEVISION consists of the following components.

4.1. Local Area Network and Database

The system is based on an Ethernet network running LAN-Manager software from MicroSoft. This combination is rapid enough for the data volumes transferred in this application (see below). The server is a 486 microcomputer equipped with the OS/2 operating system and a disk memory able to keep the page production of typically one day. In addition to keeping the image database, the server stores set-up information controlling database maintenance and the user interface of the viewing station. Finally, the server works as a pass-through buffer for raw images on their way to the image processing station.

4.2 Interfaces to Prepress Pagination Stations

There are three kinds of interfaces to the existing pagination workstations:

- *PostScript file.* In this case the PostScript page descriptions are interpreted into a contone CMYK file. At this stage, PAGEVISION does not perform the interpreting, so the prepress system has to take care of this part. In this study, the the Quark Xpress pages were interpreted on a Macintosh II fx machine by the program called "Freedom of Press Professional" from Custom Applications, Inc.

- *Screen dump.* The page or a two-page-spread is displayed by the pagination program on the screen and the screen is dumped into an RGB file which is transferred to PAGEVISION. The dumping is carried out by normal software on Macintosh or PC/Windows machines. The resolution is that of the monitor.

- *Digitizing the monitor RGB signals.* The digitizing card developed jointly by TT Oy and VTT gives a horizontal resolution of more than 512 pixels per line - the exact value depends on the refresh rate of the monitor. All the horizontal lines of the monitor are digitized. Naturally, the format of the page image produced in this way is RGB.

4.3. Plate Scanner

An in-line plate scanner, NPS-S, manufactured by Data Oy Engineering since the year 1986, is used to read the page image data for page vision purposes. The NPS plate scanner is a fully automatic high-capacity scanner which can be connected to any platemaking line. The scanner scans automatically all the plates passing through it. The plates are identified by a code (normally a bar code). The scan results and the identification data are transmitted (serial connection) to the press automation to enable the presetting of the inking. [Dat].

The scanner comprises a line scan CCD camera with 1024 elements, a measurement hood with illumination, a vacuum conveyor, a standard industrial microcomputer run

under MS-DOS, and a highly sophisticated software. The scanner reads the CCD camera readings with a resolution of 12 bits.

A standard NPS plate scanner from the year 1987 was used in this work. The scanner computer was equipped with an Ethernet controller board and appropriate software, to enable the scanner to operate as a workstation in a LAN-Manager network.

In normal operation the scanner builds for each plate a pixel map image in its RAM. The scanner computes the percentages of the printing image for each inking zone. The results are calibrated according to the readings from two calibration fields in the bending area of the plate. Finally, the scan results with the plate identification are transmitted to the press automation.

In the PAGEVISION setting, the scanner was programmed to output the pixel map image from the memory through the Ethernet network to a file in the server computer. To make the amount of information smaller, the resolution of the image was changed from 12 bits to 8 bits. In addition to the pixel map, the file contains the coordinates of the plate corners and the necessary information for plate identification.

4.4 Image Processing Station

The image processing station is a MS-DOS microprocessor. It transforms the scanned plate images into the page or two-page-spread images which are coded according to the TARGA image file format and stored in the database on the server (*Figure 2*).

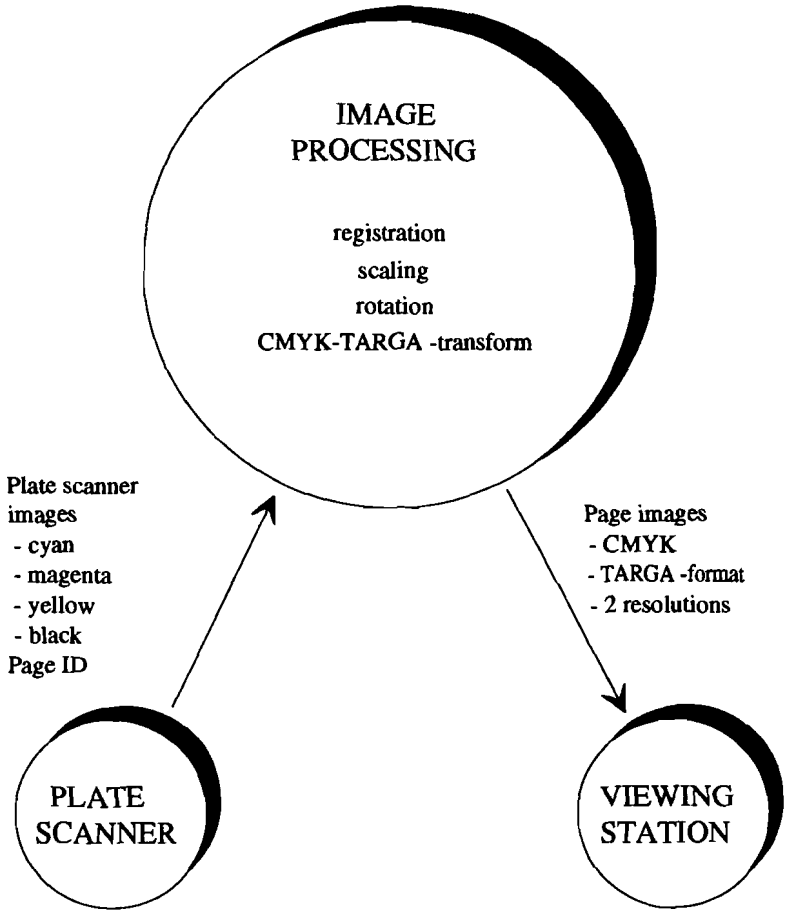

Figure 2. The function of the Image Processing Station.

The rotation and misregistration between the different plate scanner images are removed and the images are scaled to the desired resolution. The CMYK image is converted into the TARGA image file format.

4.5 Viewing Station

The viewing station retrieves the page images from the database on the server and shows them in windows on the screen. The software is based on Windows 3.1. A full-colour 24-bit graphics board displaying 1024 (H) x 768 (V) pixels is used together with a large monitor (20"). In addition, the graphics board allows rapid hardware zooming of the page images.

The program was developed in object-oriented C, using class libraries. This clearly speeded up the development.

By using the mouse the user can browse through several products currently under production. At our test site in Varkaus two newspapers were programmed (*Figure 3*).

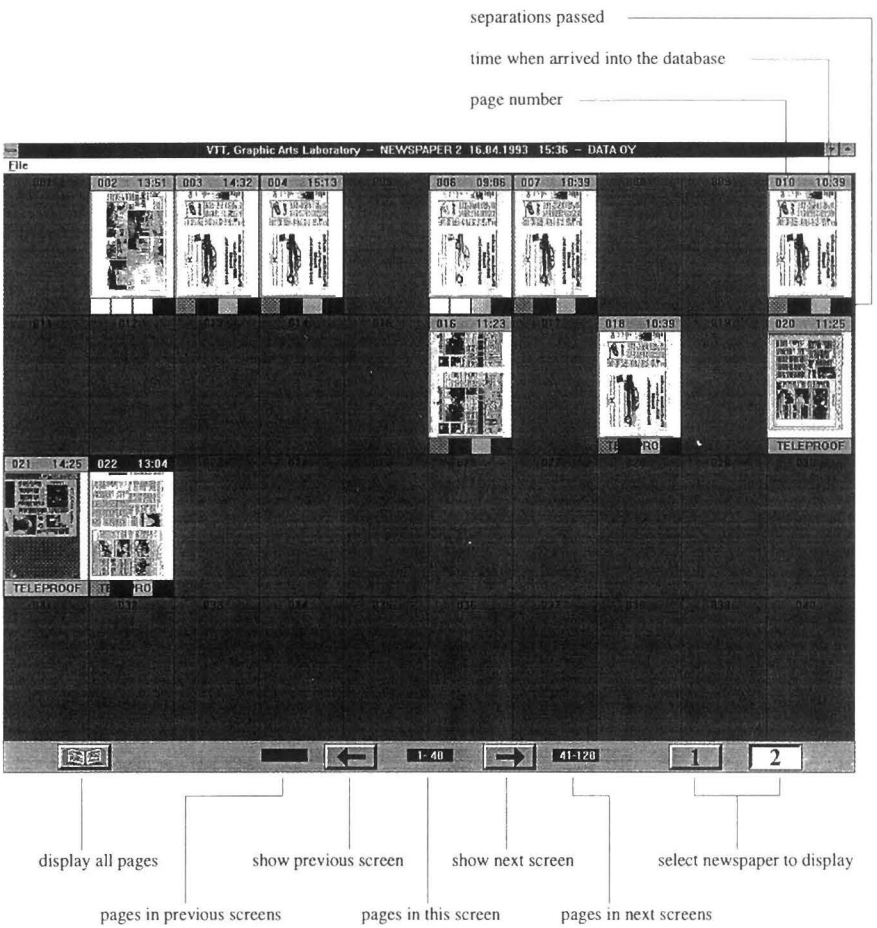

Figure 3. The basic display at the viewing station.

The layout of the thumbnail pages on the basic display is adjustable - a suitable number is 10 (H) x 4 (V) pages. As can be seen from Figure 3, the pages are browsed in steps of 40. The page is viewed in more detail by clicking at it (*Figure 4*). All the pages of the printing product can be viewed at the same time (*Figure 5*). Tabloid pages are displayed as rotated 90^0 corresponding to the way the press crew views them.

The pages are ordered by the page number displayed in the upper lefthand corner of the window. With tabloid plates, the number refers to the smaller page number. Upper righthand we have the time, when the page arrives in the database. With plate scanner pages, this time corresponds to the last scanned plate (C, M, Y or K). The separations which have passed through the plate scanner are indicated beneath the image. The pages coming from prepress pagination are indicated as teleproofs. The zoomed page also indicates how the teleproof has been created.

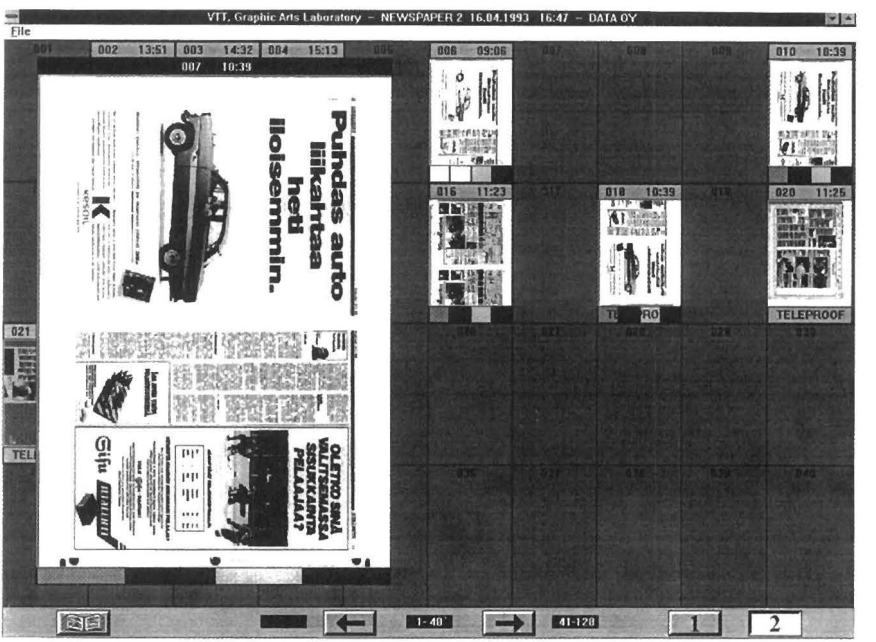

Figure 4. Viewing a scanned plate in detail.

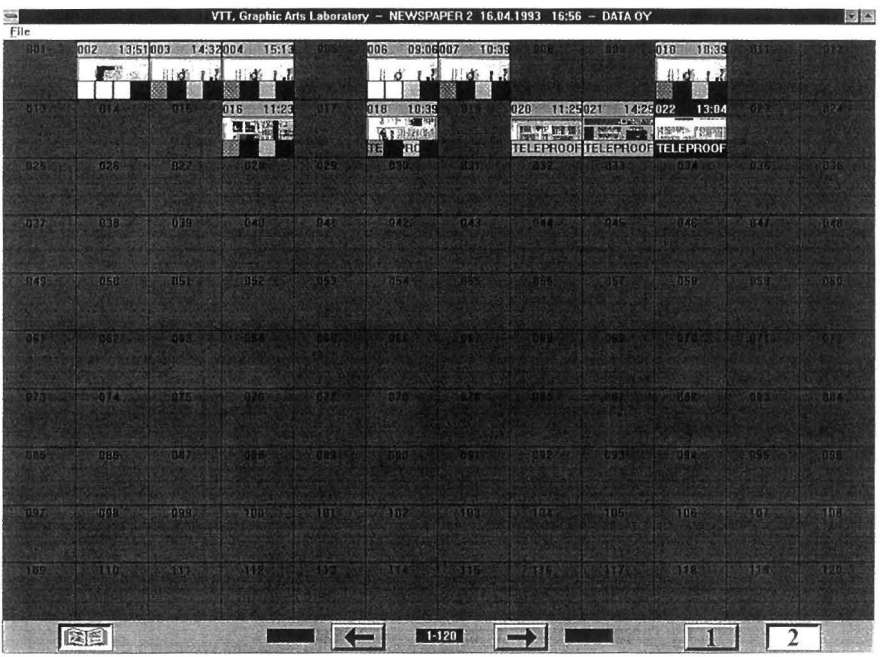

Figure 5. All the pages of a newspaper under production.

If a page is in the database both as a plate scanner image and a teleproof image the images are overlayed on the basic display. When the page is zoomed, both versions are displayed side by side (*Figure 6*).

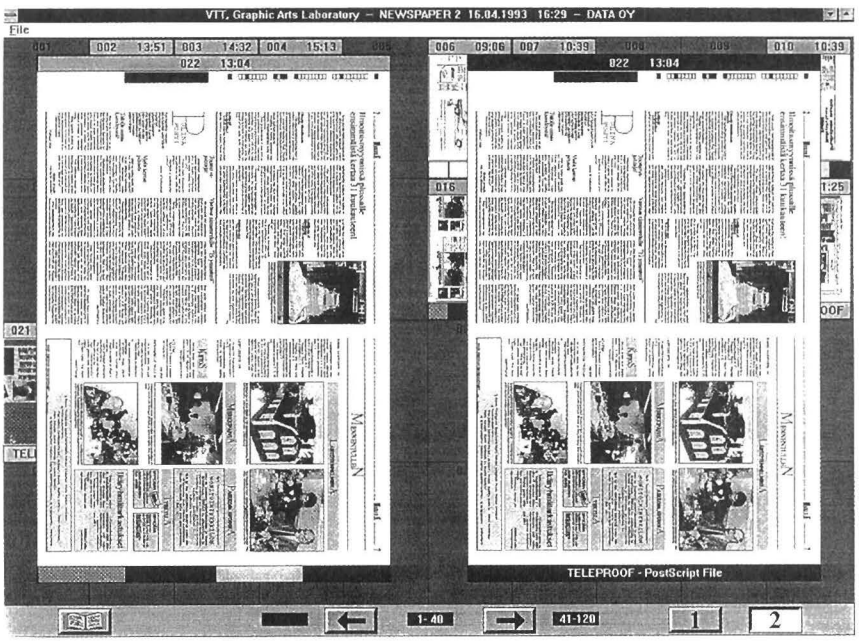

Figure 6. A plate scanner and a teleproofed version of the same page. The teleproofed page is created from its PostScript description.

6. EXPERIENCES MADE AT THE PILOT INSTALLATION

The pilot system was installed in the city of Varkaus at a satellite plant of a major Finnish publishing and printing house - Sanomat Oy. The plant prints the daily newspaper, Helsingin Sanomat, (70 000 copies a day) and the afternoon paper, Ilta-Sanomat, (67 000 copies a day) for distribution in the eastern and northern parts of Finland. The pages are faxed from Helsinki to Varkaus over a 2 Mbit/s leased line and output on films.

No link to pagination was established in the pilot setup. The PAGEVISION was connected to one of the two NPS-S plate scanners. In the tests the size of the pixel map was 600 x 400 pixels.

Under normal production, the scanner needed 4 seconds to build the pixel map file on the server, which did not slow down the normal plate scanner operation. The computatuons in the image processing station, including file loading, registration, rotation, image forming and transfer back to the server, took 15 seconds per plate (1 minute per four colour page). As the average scanning rate of the plant is one plate per 2.5 minutes, the image prosessing station does not form any bottleneck.

One viewing station was installed in the press control room. The performance data of the station were as follows:

- displaying a page in full resolution on the screen from the local database — 3 seconds
- displaying a set of 40 thumbnails from the local database — 11 seconds
- updating the local database from the server + CMYK-RGB conversion +forming a thumbnail — 8 seconds

The press crew judged the image quality as satisfactory. They considered the system to be of significant use in their printing operations.

7. CONCLUSIONS

A system for displaying page images orginating from pagination stations and plate scanners has been constructed. The page display system was in a pilot test found to be of great help in creating an overview of the production and to aid the platemaker and the pressman in their operations, especially in a remote printing environment. The system based on standard hardware and operating systems and is therefore easy to customize for different environments. A project has been launched recently to develop the pilot into a commercial product.

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