Digital Publishing

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Abstract

This presentation covers the general topic of 'Digital Publishing' in the context of

- *the German M$_E$DOC Project and*
- *the German Strategic Digital Library Initiative V^3D^2 and, more specifically,*
- *in the context of organizing EUROGRAPHICS'97 from the publication point of view.*

M$_E$DOC is an effort by the German Computer Society (GI) to identify and to address the implications and challenges of digital libraries and electronic publishing on a wide scale. Starting in September 1995 the M$_E$DOC project, partly funded by the German Ministry of Technology, has not only tried to implement a novel architecture for bringing relevant documents to the researcher's desktop it has also raised the awareness on this important subject within the scientific community as well as within the group of publishers.

The scientific counterpart to the application oriented M$_E$DOC project is the strategic initiative V^3D^2 which is the (German) acronym for 'Distributed Processing and Delivery of Digital Documents'. This initiative, funded by the German Research Foundation (DFG) over a period of six years and starting in 1997 provides a solid base for researchers from different disciplines (Computer Science, Library Sciences, Applied Sciences, . . .) to tackle basic research and application issues focusing on 'generalized electronic documents'.

EUROGRAPHICS'97 is the first conference in its series to fully exploit the power of electronic documents and computer networks. This year, the submission of papers, the delivery of papers and attached multimedia material to the IPC members and to the reviewers as well as their online access, the feedback to the authors, and the delivery of the final documents (with the accompanying multimedia data) has been (almost) exclusively carried out electronically.

This report briefly describes the architecture behind the work of the program committee from the first call for papers to the production of the printed proceedings and the CD-ROM holding the technical papers, STAR's and tutorials. The experiences and lessons learned might be valuable to a general audience and not only to those organizing a scientific event in the near future.

1. Introduction

In order to make the wide topic of 'Digital Publishing' or 'Digital Libraries' managable within one STAR this presentation gives a brief report on the setup and experiences of the application-oriented M$_E$DOC project, which has just been finished by the end of August 1997.

This section is followed by a brief discussion of the concepts and the design of the Strategic Digital Library Research Initiative V^3D^2 funded by the German Research Foundation (DFG) which is about to gain momentum by late summer 1997.

The third part of this presentation consists of a practice-and-experience report on the editorial work behind the (electronic) publications for EUROGRAPHICS '97.

2. Project M$_E$DOC

M$_E$DOC, the acronym for *Multimedia Electronic Documents*, is the result of an initiative by the German Computer Society (GI) to stimulate the use of electronic media in computer science and to simplify the access to scientific literature for researchers as well as for students.

Starting with an informal meeting in December of 1993

this initiative motivated a small group of researchers[†] who, together with two industrial partners – FIZ Karlsruhe (a German database provider) and Springer-Verlag Heidelberg – developed the final project scenario.

The MₑDOC Project officially started in September 1995 for a period of two years, partially funded by the German Federal Ministry of Technology (BMBF). The full title *'Development and Evaluation of an Open Fulltext Information System for Computer Science'* already indicates that this application oriented project tried to implement a novel architecture for bringing relevant documents to the researcher's desktop.

The specific goals of the project were to

- provide a 'critical mass' of computer science literature as online documents
- evaluate and develop processes and tools to support the operation of a digital library
- design an information broker to assist users in selecting relevant databases from various and inhomogeneous internet resources

2.1. MₑDOC and Digital Publishing

In order to provide a significant amount of electronic material the MₑDOC Team had to become deeply involved in various aspects of the digital publishing process: selection/acquisition and conversion of adequate material and establishing an online access service, including licensing concepts.

By the end of the project the MₑDOC Library (see [14]) will contain some 30-40 journals, some 80-100 books and more than 1000 technical reports. The selection of books and journals was based on serveral surveys carried out mainly within the group of 'pilot users' – 24 universities, colleges and research institutions also participating in the project. Of course, the list of books finally converted into electronic form was also influenced by the list of participating commercial publishers[‡] currently offering scientific literature in the German market. For many of them, the MₑDOC Project was the first close encounter as well as a hands-on experience with the issue of digital publishing.

The conversion activities, currently 55 books, did raise

the awareness within the publishing houses for the many details which need to be resolved to go from a standard printed document to an online service. This includes the discussion about

electronic formats:
currently only HTML or PDF [4] with a preference to PDF because of its presentation quality and the built-in fulltext search facility for a group of PDF documents (provided by Adobe's *catalog* tool).

re-use of existing data:
with the exception of those cases were authors would do the conversion themselves, economic reasons restricted the set of books to those were the publisher could provide a LATEX or Postscript file. Even then, either dedicated LATEX macros or a set of tools operating on the Postscript files had to be developed to make the conversion task economically feasible.

online access, multimedia server and licensing:
providing online access through the internet on a cost recovery basis without the reliable availability of electronic cash or payment procedures resulted in the implementation of a fairly complex licencing scheme [5] which is also closely connected to the functionality of the User Agent (described below).

During the project the non-exclusive right for electronic storage and display for a total of 80 books and 22 journals could be acquired and had to be protected through various licencing contracts. The result was a fairly complex accounting scheme.

By the end of the project web server technologies have matured to a level of functionality that access control and payment could also be implemented without developing proprietary software to that significant extent.

With regard to technical reports the project team after evaluating different approaches eventually agreed to use NC-STRL [15, 11, 6] because of its distributed nature and its increasing international popularity. However, the cost to enter technical reports is still quite siginificant and seems to be the main reason for a limited growth rate.

As an alternative to NCSTRL the New Zealand Digital Library (NZDL) concept [16] which offers a *fully automatic* setup of technical report based on postcript files has been installed at the University of Bonn as part of the MₑDOC activities [9]. All ftp sites holding technical reports in Germany and known to the group in Bonn (1,930 technical reports from 29 sites totaling 57,884 pages) have been automatically inserted into the NZDL-Server and can now be searched on a fulltext basis. Additionally, 1,244 images have been automatically extracted to give a better idea on the content of an individual technical report. Further details as well as the search form can be found at
http://www.graphics.uni–bonn.de/NZDL

2.2. MEDOC System Architecture

The electronic material described above is accessible through a network of distributed MEDOC servers, basically consisting of a fulltext server with a web interface. With regard to the overall design shown in Figure 1 each MEDOC server also acts as server database.

Even though MEDOC has been developed independently from the University of Michigan Digital Library project [3] the system diagrams show quite a similar structure.
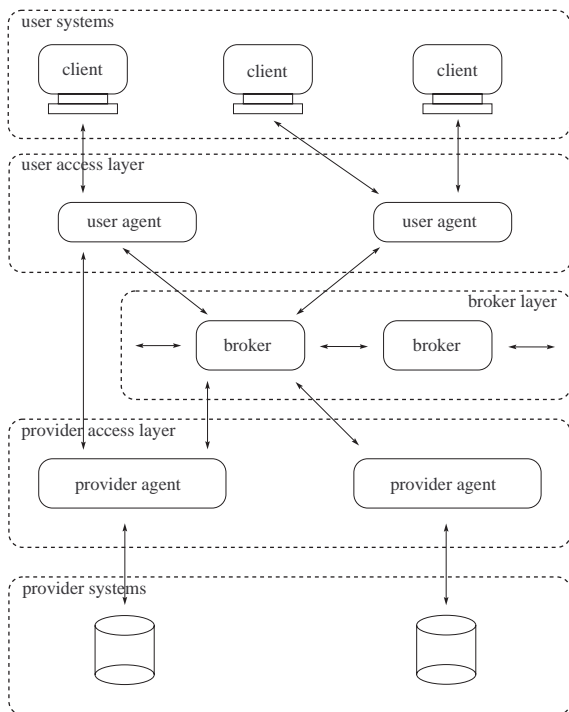

Figure 1: *MEDOC System Architecture*

The end user interacts through his or her favorite web browser with a so called *User Agent* [10]. This module, typically installed once per participating institution, takes care of user identification, storage of user profiles, continuous connection to the overall system, and local storage of query results.

Figure 2 and 3 show screen shots of the User Agent's current user interface to issue a query to the broker and to retrieve the results.

Of course, as shown by Figure 1, the user can explicitely direct a query to a specific provider or can directly access an information provider's database – e.g. a MEDOC server – and 'navigate' locally. Figure 4 shows the user interface related to this feature of the User Agent.

By default, the query will be handled by a broker which maintains a database of descriptive data (meta data) about

Figure 2: *MEDOC User Agent: new query*

the content of typically several providers. To reduce the wast information space the broker (or mediator) evaluates the query and recommends a (short) list of databases for further investigation.

Database providers either offer literature references or 'fulltext' material, which, of course, can be more than text. In case of reference data the actual delivery of the material will not happen under control of the MEDOC system. In case of fulltext material the *Provider Agent* will encapsulate the provider's data (to establish a common interface) and deliver the document electronically under MEDOC's control. The Provider Agent also takes care of provider specific access control and accouting.

3. Strategic Initiative V^3D^2

The scientific counterpart to the application oriented MEDOC project is the strategic initiative V^3D^2 [7, 8] which is the (German) acronym for *Distributed Processing and Delivery of Digital Documents*.

The motivation to apply for such a strategic initiative was to a great part the outcome of a comparison carried out by
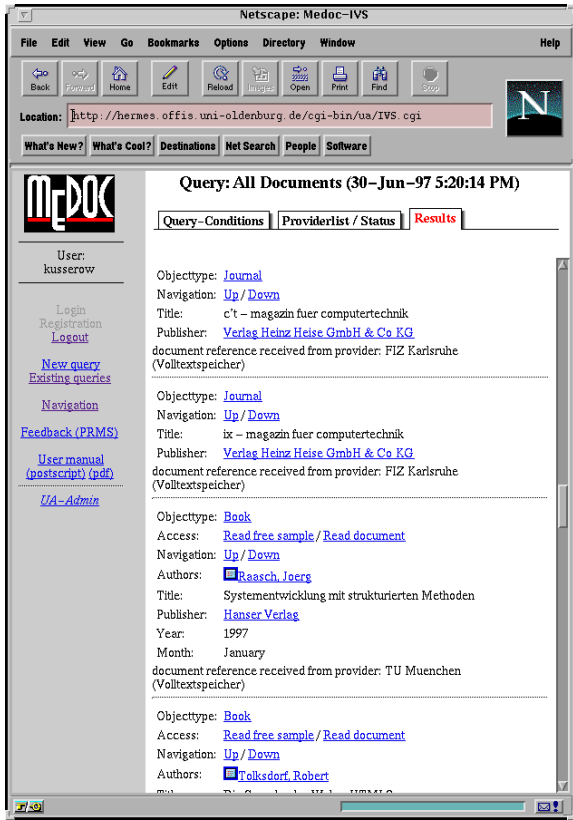
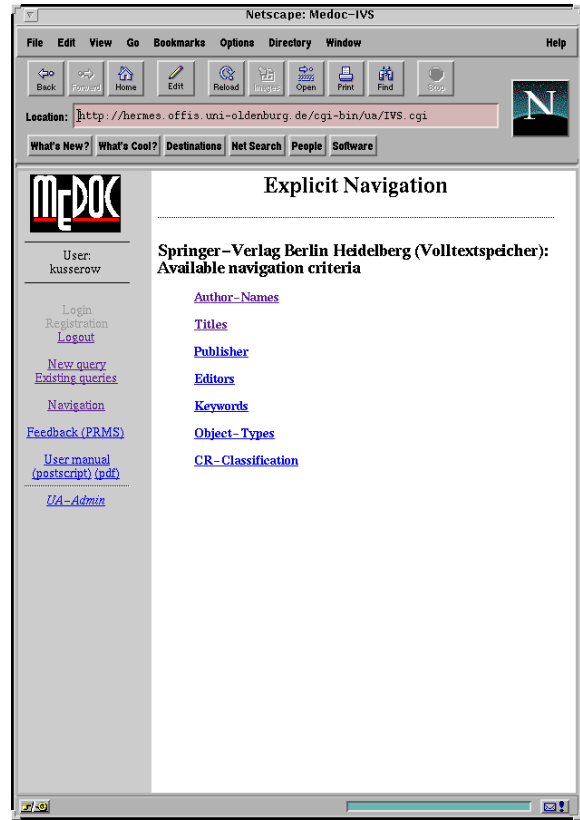**Figure 3:** M_EDOC User Agent: results

Figure 4: M_EDOC User Agent: navigation

the author between the development of the World Wide Web and the concept of telematic systems in the late 70's. In a nutshell, the comparison revealed that by the end of 1994, the World Wide Web did not provide anything which hasn't been available by advanced Videotex systems at the beginning of the 80's. As it became clear that the demand for basic research activities would not be addressed within the M_EDOC project the author together with T. Ottmann (Univ. Freiburg), P. Rau (Univ. Bonn), and H. Schweppe (FU Berlin) started with the preparation of a strategic inititative in the field of 'Electronic Documents' and 'Digital Libraries'.

This initiative was approved by the German Research Foundation (DFG) in May 1996. Coordinated by the author, the initiative is set up for three installments over two years each, with the research work starting in late summer 1997. It provides a solid base of approx. DM 5 Million funding per year for researchers from different disciplines (Computer Science, Library Sciences, Applied Sciences, ...) to tackle basic research and application issues focusing on 'generalized electronic documents'.

The scientific goals of this initiative can be summarized

as research and development for new techniques to build and use 'Digital Libraries' or to

- *create*
- *distribute* and
- *use*

electronic information in a general context. The approach taken is to develop

- *basic techniques*
- *elementary system components* and
- *applications*

resembling the building blocks of future 'Digital Libraries'.

Among the most prominent open problems which will be addressed in the first funding period are

Retrieval & Filtering:
currently, users are drowning in electronic data at the same time they are fairly unsuccessful in fighting the lack of *relevant* information. Only sophisiticated retrieval and filtering techniques, including approaches like content-based retrieval in image or video databases or semantic information filters will be able to change this situation. Of course, good feedback strategies and relevance ranking is

still an open problem for textual databases. However, priority is given to the tight integration of multimedia material and document retrieval.

Maintenance:

already the maintenance of a small set of hyperlinked web pages can become a web master's nightmare. As soon as the pool of information expands the hypermedia material becomes unmanageable and the information becomes outdated and full of dangling links. Obviously, there is a tremendous demand for scalable information server technology, i.e., true distributed multimedia databases.

Meta Data & Markup:

current discussions on HTML in version x.y are a strong indication of the deficit in this field. In order to build digital libraries which have at least the potential for lasting some time we all need usable concepts to handle presentation, markup, *and* meta data (sorted form the indiviual author's point of view). Of course, priorities are sorted differently from the librarians perspective.

Another important topic is the authenticity of digital documents with regard to content. Digital watermarking seems to be a promising approach to cope with this problem.

Personal Libraries:

as each individual is typically interested in a particular arrangement of information there is an obvious need to develop personalized 'views' into the vast digital information universe. The speed, at which bookmarks at web pages (maintained by our web viewers) become outdated is a good indication how important this problem really is.

Delivery, Compression & Navigation:

even though we rightly assume that network bandwidth will improve, we are also facing a dramatic increase in the volume of material pushed around in the internet. Especially, as soon as real-time or interactive constraints are being introduced we need to worry about synchronization of parallel streams e.g., video and audio, (hierarchical) compression and level-of-detail, specifically for 2D and 3D graphics, and about navigation in distributed documents, from a compound text-based document to a 3D virtual environment.

Multi-media based Tele-Education:

Computer based teaching (CBT) material can be viewed as just one particular set of electronic documents. However, due to its strategic importance the creation and distribution of CBT data will be handled seperately. The most important questions related are the integration of various data & document formats, the synchronisation of presentation & simulation, the compression of voluminous data, the creation of integrated editors to handle various media, and tools for network based distribution.

As already mentioned above the first funding period will start later this summer. The core research team will consist of 35 researchers (augmented with 36 research assistants) located at 16 German universities.

4. EUROGRAPHICS '97 – Going Digital

Eurographics'97 is the first conference in its series to fully exploit the power of electronic documents and computer networks. For this conference,

- the submission of papers
- the delivery of papers and attached multimedia material to the international programme committee (IPC) members and to the reviewers as well as their online access
- the feedback to the authors and
- the delivery of the final documents (with the accompanying multimedia data)

has been (almost) exclusively carried out electronically.

This section briefly describes the architecture behind the work of the IPC from the first call for papers to the production of the printed proceedings and the CD-ROM holding the technical papers, STAR's, and tutorials.

4.1. Submission

The Call-for-Papers invited electronic submissions and printed copies, with the preference clearly given to the electronic route. Authors were asked to submit their paper as a gzip-ed postscript file by FTP to Budapest, Hungary, the location of the conference venue. In order to be prepared for almost all authors submitting their paper in the very last minute, a backup FTP server has been set up at the University of Bonn, Germany.

To everybody's surprise authors started well before the deadline – January 17, 1997 – to transfer their submissions to Budapest. The transfer itself worked smoothly in most cases. The only significant problems have been reported from colleagues in Austria, France, and Israel. From these countries authors simply couldn't transfer their papers to any of the two ftp sites.

A short test revealed the fact that the internet connection from all of these countries to Budapest as well as to Bonn were routed through Paris, France, where the lack of bandwidth made ftp connections simply impossible. Even a command to list the contents of a directory would eventually timeout without listing a single file!

As a quick solution authors were asked to gzip and uuencode their submissions and send them by email. This worked without problems.[§]

The lesson learned is that email is currently more reliable in delivering submissions. It might take a little while but,

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[§] Due to this last minute action all emails went to the IPC chair's mailbox filling it up very quickly with many megabytes of postcript data. It should be observed, that a separate user/mail-id for conference purposes only – not just an email alias – enables the person in charge to continue his/her normal business life. Something which is not true otherwise.

compared with FTP in some countries, it worked at the speed of light. The additional benefit of this approach is the fact that the mail system will buffer unexpected peaks caused by too many authors submitting at the very last minute.

Of course, life would be much too easy, if all mailers were properly supporting the MIME protocol. As long as this isn't the case, the best option is to use a MIME compliant mailer at the receiving side and to ask authors either for MIME attachments or for gzip-ed and uuencoded material.

In summary, electronic submission has been widely accepted by the authors. This is supported by the fact that from 112 submitted papers only 14 arrived in printed form only. Two authors provided both, electronic and printed, because they felt that the printed reproduction of the images is relevant for the reviewing process.

Comparing this to the list of finally acccepted papers, it turns out that only one paper-only submission has been accepted (of course, acceptance was *only* based on quality) for the conference. Interestingly, the authors of this contribution had no problem to deliver the final version in electronic form. They didn't even need a revision cycle to fully match the desired format (see below).

4.2. Reviewing

Online access to *all* electronically submitted papers has been provided with a Hyperwave [12, 13] server, a multimedia web server with lots of handy features supporting the maintenance and access control to a web information base. Access control for the registered user is based on the membership to one or more (hierarchical) groups, inheriting access permissions. IPC members had access to all submissions whereas reviewers were granted access on a need-to-know basis only.

With 33 IPC members and approx. 160 reviewers the management of the access control is only one issue to be resolved. The real time-consuming task, at least for conventional web servers, is the creation of the 160+ index pages for each individual reviewer. We could not have managed this without the features of Hyperwave which

1. handles groups of web pages very well. In our case PDF files with attached multimedia material like TIFF images, MPEG clips, ... were collected in so-called *collections* which can also contain other collections.
2. dynamically creates the index page for each collection, taking care of individual access rights.

These two functions are the key to an efficient management of an online submission/conference server. Due to the automatic and dynamic creation of index pages for each collection, there is no need for manually creating or, even worse, maintaining the 'inner nodes' of this 'web' (which is really a directed acyclic graph). Not a single explicit hyperlink has been created during the whole operation.

When a user accesses a specific collection, its content (i.e., the documents grouped by it) is individually checked for proper access permission. Only those documents which the user is allowed to access will be included in the list. Thus, all IPC members and reviewers would access the submission server at the same entry point but each reviewer would see a different page (assuming that no two reviewers had an identical list of papers to review) holding a different set of submissions to review. Only IPC members would see the full list of electronically submitted papers.

Uploading of submitted papers to the Hyperwave server and control of access permissions has, for the reviewing, been done with dedicated Hyperwave clients. In the meanwhile, as for the online presenation of the final papers, STAR's and tutorials, uploading is done with standard web clients like NetScape or Interent Explorer. Thus, the typical data flow would consist of postscript files arriving by email which are then stored locally and converted to PDF (by the Adobe Distiller). The resulting PDF files were checked for completeness and consistency and uploaded to the web server.

After the submission deadline, papers were assigned to IPC members by sending lists of submision ID's (could be URL's) to the individual IPC member asking him/her to organize the reviewing for the particular list.

The benefit for the IPC chair is obvious:

- papers don't have to be sent by standard mail which reduces the cost of shipping
- papers arrive at the speed of the internet which is definitely faster than even courier mail
- additional 'copies' can be distributed without extra effort or cost

However, it must be observed that the cost of reproducing the submissions is now shifted to the group of IPC members and reviewers as they have to actively *pull* the papers from the server and print them locally – in contrast to *pushing* the hardcopies onto their desk. Despite the significant data reduction resulting from the conversion from Postscript to PDF the time for loading and printing, especially at the IPC member's site, can easily become significant.

With the current speed of the internet the lesson learned for the distribution of the papers is that IPC members, due to the typically high number of papers they manage, should have the option to receive printed copies. For reviewers the distribution by electronic means (pull) seems to be acceptable as the number of papers is typically low.

4.3. Production of Hardcopy and CD-ROM Proceedings

For a number of years now the conference proceedings for the annual event have been published as issue Number 3 of the journal *Computer Graphics Forum*. Being one issue of a journal there was an obvious desire to make the conference proceedings fully blend in with the regular issues. Further,

the conversion process from postscript to PDF can be significantly improved *and* automated if an appropriate style or template can be offered to the authors.

Experience from EUROGRAPHICS '97 tells us that the majority of authors use LATEX for the typesetting process: only two of the finally accepted papers were compiled with a different system (one in Framemaker, one in Word). Thus, the time to adapt the LATEX style of the *Computer Graphics Forum* to provide the necessary support for the conference proceedings, tutorials, and STAR's was well invested.

Actually, it was the only feasible way, to enforce the use of Adobe's Type 1 fonts which are absolutely necessary to achieve a good quality for the electronic versions.

The issue of Type 1 fonts is closely related to the decision for PDF as the main format. Currently, the only alternatives to produce electronic documents at high quality and at feasible cost are HTML and PDF. Considering HTML's limitations with regard to presentation of mathematical expressions there was no alternative to PDF.

In summer of 1996, the reluctance among many colleagues to use PDF as the main format was largely based on either the unfamiliarity with the functionality of PDF or on the assumption that PDF viewers would not be readily available to the IPC members, the reviewers, or the end users of the electronic version of the conference proceedings. Fortunately, PDF viewers and plug-ins for web clients matured and became commonly available on many platforms within a short period of time. As a result, no problems related to the choice of PDF have been reported during the reviewing process.

The production of PDF documents can be achieved in many ways. Almost all office packages directly support PDF as a native output format. In the Microsoft Windows world, PDF files can generally be produced from any application by printing to a virtual printing device which does the conversion to PDF. Adobe also provides the *Distiller*, a tool which converts postscript files into PDF. In the public domain, conversion from postscript to PDF can also be done with *ghostscript*.

Although any reasonably well-behaving postscript file can be converted to PDF, this does not necessarily produce an acceptable quality. The primary reason being, that many document processing systems use raster fonts at a given resolution (from 180 dpi upwards). Of course, printing the resulting PDF file will produce the same result on paper than the original postscript file. However, the displayed quality for online reading – and this is an essential functionality – is not acceptable. With current technology, postscript files store raster fonts as medium to high resolution pixel arrays. This representation cannot be changed easily in the conversion from postscript to PDF which forces the PDF viewer to downsample these pixel arrays (to approx. 72 dpi) on the fly, producing unreadable text (except for large zoom factors).

The solution to the problem is to inform the PDF viewer about the nature of each font. Instead of handling pixel arrays – which could represent anything, not just a character of a specific font – the PDF viewer has all relevant information on the character to be displayed and can, in case of the geometrically defined Type 1 fonts, optimize an anti-aliased bitmap for speedy and high-quality display.

Realizing that Type 1 fonts are very well supported by all PDF viewers the remaining task was to produce postscript files (almost) exclusively making use of such fonts. For packages like Framemaker or Word this can be achieved by simply selecting an appropriate font from the font selection menu. For LATEX, the style mentioned above had to be augmented by another style called dfAdobe.sty[¶] which wasn't too difficult at all as LATEX2e now comes with a rich set of functionality to control the font selection. This substyle (called package according to LATEX2e) redefines the font selection for font families serif (rm), sans serif (ss) and teletype (tt). It also redefines most of the characters from the math alphabet, thus automatically producing very readable results at the end of the conversion pipeline (LATEX – postscript – PDF).

Additionally, it should be noted that the choice for PDF as the 'backbone' for electronic conference proceedings also provides an integrated *fulltext search* facility over *all* documents in an archive or on a CD. Of course, cross-document fulltext searching is a feature of Adobe's viewer whereas the creation of the fulltext index is done by a separate package, called Adobe *Distiller*.

As a side effect of having a consistent format for the regular issues and for the conference issue the two-column format significantly reduced the amount of pages used for the proceedings. Considering the hassle of each editor to have authors observe the given page limit, this fact should not be ignored.

Problems Experienced

As already mentioned, out of 38 finally accepted papers 2 papers were not produced with LATEX. The authors approximated the LATEX layout as closely as they could but, still, some finishing touches like the copyright notice at the first page had to added by the editor.

If low-level hacking, i.e., directly editing the postscript file, is not an option, editors need a tool providing comfortable access at the document level. *Re:Mark*,[2] for example, is a plug-in to Adobe Acrobat [1] which is designed for exactly the task of electronically editing a PDF document. Missing text parts can be entered as attachments which can also be made 'permanent' by making the attachments an integral part of the document. Having added the missing bits and

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[¶] available from http://www.graphics.uni–bonn.de/EG/EG97proc/

pieces to the header page of one paper, the attachments can be stored and added to other papers in one single step.

From the remaining 36 papers, 3 authors were not able to configure their LaTeX/dvips environment in order to produce a postscript file of the desired quality. In these three cases the LaTeX sources together with the included postscript images were sent to the IPC chair who ran the final production run. After some investigation it turned out that not the LaTeX class/package/style was the problem but the configuration of the dvips tool, converting the dvi-file into postscript. Instead of storing Type 1 font references in the postscript file these configurations would replace the font references by raster definitions of the according Type 1 fonts.

The lesson learned from this problem is that conference organizers also need to provide a dedicated configuration file for dvips (psfonts.map) to warrant proper font definitions in the resulting postscript file.

Roughly 50% of the authors needed one revision cycle which, in most cases, only consisted of including the package dfAdobe and re-running LaTeX. The other 50% submitted a final version exactly matching the specification given in the guidelines for authors.

Reflecting the discussion with the authors, editors are well advised to make the templates or LaTeX styles already available well *before* the initial submission deadline. Even if some details are missing from the style files at this stage, it's fair to assume that the style would not change too radically. Layout decisions on the number of columns, for example, affect the way authors place their images in the text. More importantly, the page limit for submissions can only be defined together with a given layout.

4.4. Summary

Altogether, the experience with our approach of following the electronic route for many aspects of the IPC/editor work is very promising.

- Electronic submission, based on email, is a reliable vehicle. With increasing support of full MIME compliance much of the work to extract the original data sent by the authors will disappear.
- Online access to all submissions is a real added value to IPC members as they get a better feeling on the overall quality of papers.
- Complexity of the online server management with regard to access rights is very high and must not be underestimated. However, new web server concepts are available, almost completely eliminating this time-consuming task.
- *Push* versus *Pull*: slow internet connections and many papers to load from the server can easily take too much of the time IPC members are willing to spend on the event. Whoever is supposed to review a larger number of papers should have the option to have the papers delivered in printed form.

- Placing the papers on an online server is an important milestone for the production of a CD-ROM. It serves as a testbed how well submissions could be converted into suitable formats and how easily and at which quality they can be retrieved and displayed with the suggested tools.
  It can also serve as a marketing instrument in case it is not clear if a CD-ROM should be produced at all.
- The time to create a LaTeX/LaTeX2e style which takes care of the layout and specifically supports each stage in the conversion pipeline up to the the final destination format is very well invested.
  Phrasing it differently, high quality proceedings with a uniform layout for the printed and for the electronic version cannot be produced otherwise.
- With regard to document format PDF is currently the best choice. It can easily be converted from postscript which can be produced by everybody having access to a computer. It maintains the presentation and, if care has been taken of the font selection in the production of the input postscript file, it will produce high quality output on all PDF viewers. PDF viewers do support fulltext searching across large collections of files. Finally, the support for PDF is growing quite rapidly, especially in the field of professional publishing.
- Authors were very cooperative in the production of the CD-ROM. This is documented by the significant amount of additional multimedia material provided, ranging from true-color images, animated GIF's, MPEG and quicktime movies, VRML scenes, to interactive simulations based on Java applets.

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