J.UCS - The Next Generation in Electronic Journal Publishing

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Abstract: In this paper we first discuss briefly why electronic journals today have a rather moderate success. We then describe J.UCS - the Journal of Universal Computer Science - an electronic journal that is the prototype for electronic publishing in the future. Using Hyper-G for distribution it provides all search and navigation mechanisms of large scale hypermedia systems and therefore makes it easy to locate interesting articles. Readers can perform variable scope searches to find papers, then they can browse them on screen either in hypertext mode or in high quality PostScript mode, or they can get high quality PostScript documents for printing. Even PostScript documents provide full hyperlink support when reading them on screen. Articles in J.UCS can be accessed very fast using a wide net of servers distributed all over the world. J.UCS also supports annotations to existing articles informing the readers of new research results or errors. Writing articles for J.UCS is very easy using PostScript as the main submission format, even standard hyperlinks such as literature references are generated automatically. We close this paper with a short comparison of J.UCS to other electronic journals and with an outlook on future developments.
Key Words: J.UCS, Hyper-G, electronic publishing, electronic journals.

1 Introduction

Since the rise of hypertext and hypermedia systems over the last few years many attempts have been made to introduce electronic journals, but the success was rather moderate. From our point of view the main reason for this is an acceptance problem.

Authors, readers and publishing companies have to deal with some major disadvantages:

- Special file formats are used for hypertext. The great variety of modern wordprocessors used today makes it nearly impossible to write filters to convert all the different formats to the specific hypertext format needed. Thus authors are often forced to give up their well known wordprocessing systems and instead deal with completely new and unknown software.
- Data has to be transmitted over very long distances; during rush hours the transmission rates are inacceptably low. Very often there is only a single server worldwide and large documents have to be fetched in one piece although the capacity of this server is limited to a few simultaneous users. This availability problem is not only a problem for readers but also for the authors: electronic publications that are poorly available are are considered less valuable than their paper based counterparts.

- The real power of electronic journals is found in the possibility to provide navigational facilities that make it easy to locate interesting articles. Very often those facilities are limited to a simple title search which surely is not enough.
- Electronic journals today are too similar to their paper-based counterparts. They could also contain non-printable information such as animation and sound as an explanatory add-on to the text. This would make them much more attractive for readers but preparing unorthodox material requires still an exorbitant amount of time.
- All large Hypermedia systems such as WWW, Gopher and WAIS are missing billing mechanisms making it unattractive for publishing companies to distribute electronic journals.

The Journal of Universal Computer Science (J.UCS) is the prototype of the kind of electronic journal publishing of the future [see Calude 94]. The remainder of the paper is devoted to the philosophy of J.UCS and the concepts helping to overcome the problems mentioned above. The paper concludes with a brief vision of further ideas that will be realized for J.UCS as well as for other electronic journals in the future. In this way electronic publishing will turn into a completely new form of producing publications that nobody will want to miss in the future.

2 The General Idea

Due to the rapid growth of Internet during the last few years Internet has become the most attractive network worldwide. With some 2 million Internet nodes worldwide at the time of writing an estimated 20-100 million people can connect to Internet. Additionally, nearly all researchers in computer science have access to Internet by now. This makes Internet the ideal network for distributing J.UCS. Under those premises J.UCS is not only universal in the sense that it covers all aspects of computer science, but it is also universal in the way it is accessed: readers can use it at any time, day and night and at any place worldwide [see also Calude 94].

But J.UCS is not only universial for the readers, it is also universal from the authors point of view - the main format for submitting articles will be PostScript. Nearly every wordprocessing system is able to produce PostScript output, either directly or via the printer interface whose output can be directed to a file. So the additional effort for authors preparing contributions for J.UCS is reduced to a minimum. Even all the standard hyperlinks such as literature references do not have to be created by the authors, instead they are inserted automatically by our special software that converts the PostScript documents.

The first test issue of J.UCS will appear in November 94 (vol. 0, no. 0). Regular service - for which submissions are accepted as of now - will start in January 95.

3 The Philosophy of J.UCS

J.UCS is a high quality journal. Each submission will be scrutinized by a minimum of two referees and accepted only if it measures up to the standards of

prestigious printed journals in computer science [see also Calude 94]. J.UCS is also a high quality journal considering the editorial board, consisting of over 160 eminent computer scientists all over the world covering all areas of computer science. This original editorial board constitutes the "Foundation Board" [see J.UCS 94a] and will be extended over time as seems necessary. This prominent editorial board will ensure that articles appearing in J.UCS will be considered to be as prestigious as articles in any other reputable refereed journal. There is also another aspect of high quality: the over 60 "Foundation Servers" [see J.UCS 94b] - the original servers distributing J.UCS - are found at many prominent universities and organisations worldwide.

The reputation of J.UCS as a high quality journal does not only depend on the quality of the publications but also depends on its stability. Stability means no article ever appearing in J.UCS can be changed at a later stage. This is essential to be able to quote contributions without fear that they can change as is happening in many other electronic information systems. The only form to add information to contributions is the possibility of making annotations as described in [section 6] of this paper.

J.UCS will be distributed mainly in electronic form with one volume per year consisting of 12 issues. Springer will also provide a yearly CD-ROM version and a yearly printed version for archival purposes. The CD-ROM version will include a print utility that will allow to print individual papers, or all papers, or all papers in a category for non-commercial use. With the endorsement of ACM categories are strictly following the ACM Computing Reviews categories. A complete overview of the possible categories is given in every January edition of ACM Computing Reviews [see ACM 94] or [J.UCS 94c].

Publications in J.UCS are structured into pages that are numbered consecutively so that papers can be quoted exactly like in usual journals with name(s) of author(s), title, name of the journal, volume number, issue number and page number(s).

J.UCS is operated on a non-profit basis and for a trial period of two years (i.e. 1995 and 1996) even available free of charge. After this initial period charges of $100.- per subscription (one subscription potentially serving a whole university) will be collected to recover operational costs including the cost of running a central server and potential network costs (see [section 7 Billing] for a description of the billing mechanism). Editors and referees carry out their work on an honorary basis, as is the case with most professional journals.

As mentioned before, J.UCS will also be universal in the sense that it can be accessed at any time, day and night from any place worldwide. As we have learned from other electronic journals the transcontinental transfer time of data via Internet can be annoyingly long. We are convinced that access must not be understood as just getting the data but as getting data fast.

To provide quick access J.UCS uses a wide net of servers distributed all over the world. This has two major advantages: firstly, the transfer rates from a local server to the reader's computer are very high and, secondly, one server need not deal with all readers simultaneously. J.UCS issues are transfered to the servers as they appear and are considered static in the sense that they do never change with the exception of annotations. Such annotations are also refereed (see [section 6 Annotations] for a description of the process of making annotations). Annotations are a very useful tool to alert the reader of errors, new results, etc. They are represented as references in the articles, so the reader simply clicks on

them and is lead to the text of the annotation.

Quick access to papers also includes sophisticated methods for locating those papers a reader is searching for. Therefore J.UCS provides very powerful facilities to search for keywords in the title, in the list of keywords supplied by the author or even in the whole text, by author, by category, by date or by combinations thereof. [see section 4 The Kernel of J.UCS - Hyper-G]. As an example, searching for all papers between 95 and 96 with classification H.3 or "Information Storage and Retrieval" will produce a "subjournal" of all papers of J.UCS published in those two years and classified as contributions to "Information Storage and Retrieval". Note that contributions need not be necessarily classified under only one category. Consider a typical paper on "Hypertext" - this might be classified as H.3 ("Information Storage and Retrieval"), H.4 ("Informations Systems Applications") and I.7 ("Text Processing").

J.UCS papers are all accessible in 2 forms. Firstly, as HTF documents for reading them on screen ("browsing") and naturally also for printing them in a draft mode. Secondly, as PostScript documents, for high quality prints. Note that even the PostScript documents support hyperlinks when reading them on screen. Today J.UCS is the only electronic journal providing documents in hypertext and high quality formats, and both formats with full hyperlink support.

By this concept unnecessary data flow over the Internet is much reduced: The reader can locate papers using all the search facilities described above. Papers found can be read in a "browsing mode", that means in hypertext mode, including inline images. It is not even necessary to download the whole paper: the abstract, every single chapter and the references are accessible seperately. After browsing the paper the reader can decide to get the high quality PostScript version of it. The PostScript version itself is transmitted in compressed format and automatically decompressed at the reader's computer. Since PostScript is highly compressible high quality PostScript documents are only slightly larger than their HTF counterparts, depending on their contents.

4 The Kernel of J.UCS - Hyper-G

The Kernel of J.UCS is a networked multimedia system called Hyper-G (see e.g. [Kappe 93a], [Kappe 93b] and [Maurer 94] for a detailed description of Hyper-G). Hyper-G as the first second generation hypermedia system [see Andrews 94] is today one of the most powerful multimedia systems and was developed by a team of specialists between 1989 and today. Due to contracts with a number of large organizations using Hyper-G, (e.g. a growing number of universities, museums and the European Space Agency) the development of further Hyper-G features is guaranteed till at least the year 2000.

The basis of Hyper-G is a client/server architecture with the server running on UNIX machines (e.g. SUN, DEC, HP, SGI). The clients are available for UNIX, MS-Windows and Apple Macintosh free of charge by anonymous FTP (host: iicm.tu-graz.ac.at, directory: pub/Hyper-G).

The Hyper-G server stores collections of document clusters. A document cluster contains several documents belonging together, where a document can be a text file, a PostScript file, a picture, an audio- or videoclip, even 3D scenes, or some other data type. For J.UCS text files in English (including inline images), pictures and PostScript files are permitted, initially. The textual format

for J.UCS documents is HTF, the native hypertext format of Hyper-G (a format based on SGML), more complex parts of a J.UCS paper (e.g. formulae) are stored as inline images.

Hyper-G is also compatible with WWW [Berners-Lee 92] and Gopher [Alberti 92] in the sense that WWW and Gopher viewers can be used for Hyper-G documents. We recommend, however, to use our native Hyper-G viewers for J.UCS to avoid loss of some functionality.

The central J.UCS server will reside at the IICM (Institute for Information Processing and Computer Supported New Media) of the Graz University of Technology. This central server is mainly used to distribute J.UCS issues to all the J.UCS servers worldwide, so J.UCS readers can choose a server geographically convenient for them. Organizations are encouraged to operate their own J.UCS server. Setting up a J.UCS server is easy: all that is needed is a Unix machine with a few hundred MByte of free harddisc space and an Internet connection. The software for running a J.UCS server is available free of charge via anonymous FTP. Every J.UCS server registers with the IICM and will thereby automatically be supplied with every new J.UCS issue.

5 Submissions

Submissions are sent as email to JUCS@iicm.tu-graz.ac.at with the subject [submissions] or uploaded by anonymous FTP to iicm.tu-graz.ac.at, subdirectory /pub/JUCS-incoming. They are automatically forwarded to one of the managing directors of J.UCS, initially to H. Maurer. The preferred file format for submissions is PostScript, other formats accepted are RTF, LaTeXand DVI. PostScript was chosen as the main format for J.UCS submissions, because nearly every wordprocessor can produce PostScript output, at least using a PostScript printer driver.

All articles published in J.UCS must follow the guidelines in the J.UCS style sheet available either by sending an empty email to JUCS@iicm.tu-graz.ac.at with the subject [format] or by anonymous FTP at iicm.tu-graz.ac.at, subdirectory pub/JUCS, filename style.txt. Following the rules proposed in the style sheet enables us to have a uniform layout for J.UCS and to automate the steps necessary to convert a submitted article to a finished hypermedia document including automatically created links.

The converted articles are sent to at least two editors who are refereeing the contribution. In the initial phase the referees can decide to have printed or electronic versions of the contributions sent from the managing editor. Later on refereeing will be done using a Hyper-G viewer that allows inserting comments at any point in the article. Since Hyper-G viewers are available on most platforms referees are not forced to leave their well known environment. Due to the access protection mechanisms of the Hyper-G system, the contributions to be refereed can simply be inserted into the central IICM J.UCS server, where they are only accessible by the author(s), the referees and the managing editor(s). In this way the authors can see the progress of the refereeing process and could even get in contact with the referees without violating anyone's anonymity. The referees themselves can then decide whether or not to reply to the author, again remaining anonymous.

Refereed papers are sent to the managing editor, who informs the authors accordingly. For an accepted contribution the author carries out the necessary changes and submits the final version to the managing editor once more. If the referees have asked to check the final version of the publication they have again access to it. After the author has added all necessary hypertext links (only special links have to be added manually, links to earlier J.UCS contributions and links inside the document are created automatically), and after the referees have given their OK the paper is finished and appears in the next issue.

6 Annotations

The philosophy of J.UCS is it to have static articles in the sense, that once they have appeared they never change (with the exception of vol. 0 no. 0) for reasons of stability [see section 3 The Philosophy of J.UCS]. However there is a possibility to make annotations to existing articles. An annotation is not a contribution in the research sense but a note concerning previous publications. So readers can be informed of new research results or errors.

An annotation is a note inserted into a contribution by a hypertext link that leads to its text. Since J.UCS is a high quality journal, annotations in J.UCS are also going through a refereeing process and are only added if deemed appropriate. Refereeing annotations makes it possible to insert only objective comments and prevent the misuse of annotations for personal disputes.

7 Billing

As mentioned in [section 3 The Philosophy of J.UCS], J.UCS is free of charge for a trial period of 2 years between 1995 - 1996. After this period it is necessary to collect charges to recover the central server and network costs.

For this purpose a billing mechanism for the Hyper-G system is under development allowing to keep track of simultaneous users of a certain issue of J.UCS. Thus organizations can manage the access to J.UCS issues just as is the case in libraries - the organization pays fees for a specified number of J.UCS versions and access to one issue of J.UCS is then limited to this specified number of simultaneous readers. J.UCS, although not intended to be a free publication will certainly be less expensive than comparable printed journals. As a result of the electronic nature of J.UCS all costs of printing and mailing will disappear.

8 J.UCS in Comparison to Other Electronic Journals

The idea of publishing an electronic journal is neither great nor new - so what is the difference between J.UCS and other existing electronic journals? Why is J.UCS of all journals the one to be the prototype for future publishing?

There is no other known electronic journal dealing with all fields of computer science. All other journals only cope with a part of the wide variety of themes of modern computer science. For printed journals it would be impossible to cover such a wide range of themes, because they would turn into paper monsters that are impossible to use [see Odlyzko 94]. But with sophisticated methods for

locating papers information retrieval is no longer a problem, even if a journal is as comprehensive as J.UCS. But why don't electronic journals cover wider thematic areas than they do now, and why is J.UCS able to handle the wide variety of themes of computer science as a whole?

From our point of view the reasons for this are found in the way the journals are distributed. Today's electronic journals are distributed as high quality LaTeXor PostScript files, as plain ASCII text or as hypertext accessible by WWW or Gopher. LaTeX, PostScript and ASCII files can either be downloaded via FTP or are sent as email.

Thus for LaTeX, PostScript and ASCII files the reason for a rather small area of themes is relatively clear - the information retrieval problem is the same as for their paper counterparts. In reality those forms of electronic journals are paper journals distributed in an electronic way. Please note that this is not meant to be depreciating for journals distributed in this way, the point is that they are not really using the benefits lying in their electronic nature.

Representatives for this kind of electronic journals are:

- Numerische Mathematik Electronic Edition is an electronic Edition of the paper based journal of the same name. This journal is distributed in TeXand LaTeX, every electronic issue some 2 weeks before the printed issue. Information: EM-Helpdesk@springer.de.
- Electronic Publication at MIT, publishing articles from all areas of theoretical computer science. Subscribers receive a notice each time an article is published and can download the articles from the MIT Press's FTP site in either LaTeXor PostScript format. Information: Fisher@mitvma.mit.edu.
- EJournal by the University of Albany. Themes are theory and practice surrounding electronic "text" and also social psychological, literary, economic and paedagigical implications of computer-mediated networks. EJournal is distributed in plain ASCII format using a listserver. Information: EJOURNAL@ALBANY.bitnet.
- Asia-Pacific Journal (APEX-J), serving as a medium for the sharing of information and discussion on the shape of education in multicultural, international campuses, published quarterly and distributed in plain ASCII format. Information: JamesS@UHunix.UHcc.Hawaii.edu.
- Digest of Physics News Items by Phillip F. Schewe, American Institute of Physics (physnews@aip.org). News are always posted in the Internet newsgroup sci.research and back issues can be downloaded by FTP from NIC.HEP.NET. All news are plain ASCII.

For today's hypertext and hypermedia journals it is not so clearly visible, why they do not cover wider knowledge areas. In our opinion the reason is found again in the information retrieval problem. Although the problem of finding information is simplyfied by the use of hyperlinks it is not really easy to locate papers using Gopher or WWW. All known journals distributed in the Web are based on one server worldwide. Therefore the time spent waiting for data is inacceptably high; the more data a server provides and the more people are trying to locate articles the more sluggish the system responds.

A second problem is found in the Web: Not every WWW server has WAIS installed to provide searching for keywords. Even if the search facility is available the search methods are not so sophisticated as they need to be for finding articles

on special topics or in special areas since scope of searches (like "all papers in the category operating systems published in 94 or later") cannot be applied.

Representatives of hypertext and hypermedia journals are:

- MUSE by the Johns Hopkins University is a joint venture together with the Milton S. Eisenhower Library and Homewood Academic Computing. MUSE enables networked electronic access to the Press's scholarly journals. It is distributed in the Web (http://muse.mse.jhu.edu).
- Journal of Computer-Mediated Communication (JCMC) by the Annenberg Scool of Communication, University of Southern California deals with interpersonal and social aspects in communication networks. It is distributed by WWW (http://www.huji.ac.il/www_jcmc/jcmc.html) but can also be accessed as plain text through gopher and ftp means. The first issue of this journal will appear soon.
- Electronic Journal of Combinatorics by the School of Mathematics, Georgia Institute of Technology with cooperation of the American Mathematical Society. This journal is dealing with all branches of combinatorics, graph theory and discrete algorithms. It is accessible through the Web as http://ejc.math.gatech.edu:8080/Journal/journalhome.html
- Newsletter of the National Research Center on Student Learning (NRCSL). This newsletter can be accessed by a Gopher client (gopher.pitt.edu → 7. News releases, newsletters, and newspapers → 2. Learning Research and Development Center's Newsletters or it is sent by email (Requests to Learning@vms.cis.pitt.edu, possible issues: Vol. 1, No. 1; topic: reading; Vol. 2, No. 1; topic: science learning)
- Applied Physics Letters (APL) and Physical Review Letters, both by the American Institute of Physics will be available in January 95 (APL) and by mid year 95 (RPL) will be distributed in hypertext format, either Gopher or WWW.

So what is the big deal with J.UCS that it can be universal and does not have the disadvantages mentioned? Firstly J.UCS combines both approaches to electronic publishing - it provides high quality papers as well as draft papers for browsing and searching. Secondly browsing and searching is very comfortable using Hyper-G and, we think that is the most important point, J.UCS servers are spread all over the world providing short distance access and therefore high data rates from the J.UCS server to the reader. Interesting publications are located quickly using the sophisticated search methods provided by Hyper-G. Additionally the readers have the advantage of journals distributed in PostScript: they can print articles in full quality.

9 Development of J.UCS in the Future

In the future J.UCS will not only support printable articles consisting of text, formulae and graphics, it will also support animation and sound for explanatory purposes in "multimedia appendices".

Further PostScript support will be more sophisticated by adding full text search facilities to the PostScript viewers of all Hyper-G clients. The software needed for this purpose allowing to recognize text in PostScript documents is under development. Thus PostScript documents viewed with any Hyper-G client

will support the same sophisticated search and link facilities that are found in todays HTF articles.

This form of PostScript documents will be another aspect of high quality in J.UCS - high quality output and all well known hyperlink facilities combined with sophisticated search facilities all in one provide sofar unknown ease of use for the readers of J.UCS articles.

Refereeing will be carried out fully electronically as described in [section 5 Submissions]. This will hopefully reduce the turnaround time from the first submission to the time the publication appears in a J.UCS issue.

10 Support

Support for J.UCS authors and readers can be obtained via email or anonymous FTP. General questions about J.UCS are answered automatically by the J.UCS Support Daemon. For this purpose write an email to JUCS@iicm.tu-graz.ac.at with either one of the following keywords (in squared brackets) in the subject field or one or more of the following keywords in seperate lines in the mail body. For getting the information by anonymous FTP connect to host iicm.tu-graz.ac.at, directory pub/JUCS and download the appropriate files given in brackets.

[info] General information about J.UCS, including an actual list of all J.UCS servers worldwide, the actual style sheet for authors and 2 papers on J.UCS and Hyper-G. (/pub/Hyper-G/jucsinfo.txt)

[format] The actual version of the style sheet to be used for submitting articles to J.UCS. (/pub/Hyper-G/style.txt)

[howto] Information about all you need for reading J.UCS or operating a J.UCS server and where to get it. (/pub/Hyper-G/howto.txt)

[subscribe] Subscription to the jucs-news mailing list to obtain the latest news automatically.

[latex] The LaTeXstyle file to be used for submitting articles written in LaTeX. (/pub/Hyper-G/latex.sty)

[unsubscribe] Unsubscribe from the jucs-news mailing list.

[submissions] Use this subject for sending submissions to J.UCS. They are automatically forwarded to the managing editor(s).

[testfile] Use this subject if you want to submit a PostScript file and are not sure that our conversion software can deal with it. Just send a part of your article and the J.UCS technical team will test its compatibility to our accepted file formats.

If you have special questions that are not covered by the information you can get from our general support, please feel free to send email to the address mentioned above. If the subject of your mail does not match one of those special subjects mentioned the mail will be automatically forwarded to the J.UCS technical and editorial staff and will be answered as soon as possible.

References

[ACM 94] "The Full Computing Reviews Classification System"; Computing Reviews 35, 1 (1994), 6-16.

[Alberti 92] Alberti, B., Anklesaria, F., Lindner, P., McCahill, M., Torrey, D.: "The Internet Gopher Protocol: A Distributed Document Search and Retrieval Protocol"; available by anonymous FTP from boombox.micro.umn.edu in directory pub/gopher/gopher_protocol.

[Andrews 94] Andrews, K., Kappe, F., Maurer, H., Schmaranz, K.: "On Second Generation Hypermedia Systems"; IIG Report, Graz (1994); also submitted for publication elsewhere.

[Berners-Lee 92] Berners-Lee T., Cailliau R., Groff, J., Pollermann, B.: "World-WideWeb: The Information Universe"; Electronic Networking: Research, Applications and Policy 1, 2 (1992), 52-58.

[Calude 94] Calude, C., Maurer, H., Salomaa, A.: "J.UCS: The Journal for Universal Computer Science and its Applications to Teaching"; Symposium Didaktik der Mathematik, Klagenfurt, Schriftenreihe Didaktik der Mathematik (1994).

[J.UCS 94a] "J.UCS staff"; J.UCS Home Page (1994);

[J.UCS 94b] "About J.UCS"; J.UCS Home Page (1994);

[J.UCS 94c] "How to submit -¿ The Full ACM Computing Reviews Classification Scheme"; J.UCS Home Page (1994);

[Kappe 93a] Kappe, F., Maurer, H., Scherbakov, N.: "Hyper-G - A Universal Hypermedia System"; J.EMH (Journal of Educational Multimedia and Hypermedia) 2, 1 (1993), 39-66.

[Kappe 93b] Kappe, F., Maurer, H.: "Hyper-G: A Large Universal Hypermedia System and Some Spin-offs"; IIG Report 364, Graz, Austria (1993); also appeared as electronic version, anonymous FTP siggraph.org, in publications/May-93-online/Kappe.Maurer.

[Maurer 94] Maurer, H.: "Advancing the Ideas of World Wide Web: Hyper-G"; Proc.Distributed Multimedia Systems and Applications, Honolulu (1994), 201-203. (P)

[Odlyzko 94] Odlyzko, A., M.: "Tragic Loss or Good Riddance? The impending demise of traditional scholarly journals"; Submitted to Notices AMS (1994).