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**Title:**

IPER tool: an authoring visual environment oriented to the development of educational hypermedia applications

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# **IPER tool: an authoring visual environment oriented to the development of educational hypermedia applications**

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## **0 Abstract**

Starting from the statement that hypermedia systems are useful tools for supporting the educational communication between teacher and students, in this paper we examine the requirements of an ideal hypermedia authoring tool oriented to the development of didactic products. Ease of use, production of material that is usable both in a local and in a distributed environment, compatibility with other hypertext formats and automatic, secure and reliable publishing of information are identified as the key characteristics for this purpose.

After that IPER tool, a visual environment for hypertext authoring developed at Politecnico di Torino, and especially though for helping teachers with no computer science background in producing their didactic material is introduced with respect to the identified requirements.

We list and comment the main characteristics of IPERtool from the author's and the user's points of view, give a technical description of the tool and finally consider a number of applications that we developed at Politecnico di Torino using IPERtool as the authoring tool.

## **1 Introduction**

We, like other researchers in the educational field [1] [2], consider hypermedia as useful tools for teaching and learning [3] [4] [5]; the hypertext structure combined with the characteristics of multimedia presentation offers an emotional impact on the students, the potentiality of grabbing their attention, the redundancy of the communicated information that can strike simultaneously different sensorial inputs, and an organization of the concepts which resembles the process of knowledge building.

A teacher, then, can become the author of an hypermedia tool, that will support him in the traditional communication inside the classroom or will substitute him in case of distance learning scenarios.

The motivation of the teacher in experiment this new didactic strategy is usually strong, but his unhappiness in dealing with the practical problems of the implementation can be even stronger; today the number of available commercial tools for hypertext authoring is very large, and the author usually have to choose whether to distribute the product on a telecommunication network (Internet) or to use a local support (CD-ROM).

The growing popularity of hypertexts is strictly related the increasing accessibility of the authoring process: HTML, the language for Internet publishing, is a simple language, and non-experts in computer science can learn it and produce their own pages with little effort.

In many cases, however, teachers feel that this way of authoring is a waste of their time, and think that the process of writing tags and checking the result with a WWW browser (Netscape, Mosaic, Microsoft Explorer, ...) is annoying. Often the implementation process is then committed to an assistant that could have a weaker pedagogical skill, and the communication between the two authors becomes difficult and time-consuming.

Some teachers, in addition, would appreciate the opportunity of having a way of distributing the same hypertext both on Internet and on a local support without having to reorganize and reprocess the material [6].

Another feature for helping the teacher would be the possibility of importing didactic material written in a different format (document, text, Windows Help hypertext, ...) without much effort, and to export the resulting product in a different format.

The ideal authoring tool, then, should meet all these requirements, but should also have a very simple, easy to learn, easy to use interface, possibly a visual one that operates according to a WYSIWYG (What You See Is What You Get) philosophy.

This is what we had in mind (i.e. our “model” of a potential teacher-author) when we designed and implemented IPERtool, a WYSIWYG environment for hypertext authoring developed at Politecnico di Torino.

IPERtool has been designed especially for teachers with no particular programming skill, and its aim is to give them a complete visual environment for writing their hypertexts and publish them both in Internet and in a MSWindows environment.

The idea of designing IPERtool grew from a much less challenging need: the problem of translating an already existing hypertext written for the Windows Help into an HTML one. Since the available automatic translators were not satisfying, and since we did not want to translate it manually, we started to define the requirements of an authoring tool for writing and browsing hypertext which were completely compatible with HTML and which permit the translation among the most used hypertext formats.

In section 2 we will examine the main characteristics of IPERtool from the author’s and the user’s points of view, while in section 3 a technical description of the tool will be given; section 4, finally, will describe a number of applications that we developed at Politecnico di Torino using IPERtool as the authoring tool.

## **2The author, the student and IPERtool**

Our aim was to simplify the “relationship” between a teacher-author and his authoring tool, and to guarantee a large distribution of the educational product once it is finished; we defined a number of requirements for reaching these goals:

- authoring tool easy to use
- local browser available for the local fruition of the educational products
- fruition of the educational products in Internet
- compatibility with other hypertext formats
- automatic, reliable, secure publishing of hypertexts

We will examine these characteristics in details in the following paragraphs.

### **2.1Authoring tool easy to use**

The authoring system is addressed to anyone can use a Personal Computer, and who is familiar with the usual Windows interface. IPERtool follows the WYSIWYG (What You See is What You Get) philosophy, and permits the user to see immediately the layout of the page that he is composing in the same way it will appear using an Internet browser.

The IPERtool editor permits to easily change the background and the style of the fonts or to insert pictures, frames, tables, text files, image maps, always working with dialogue windows, thus reducing the effort of memorizing the names of the elements.

The built-in help can guide the users when they have problems, and a simple step-by-step tutorial is provided to introduce the tool to the users.

### **2.2Local fruition of the educational products**

IPERtool can be used to browse hypertexts locally, without the Internet connection. Therefore also users who do not have an Internet subscription can read them, and user who have it can download the applications from the network and browse them locally. The download of a whole hypertext can be achieved in a single step: this characteristic reduces the connection time and

permits the users interested in local copy of the application to get it without browsing the hypertext and saving one page at a time.

IPERtool can be distributed as a complete authoring environment, or as a read-only browser together with an application written using the authoring tool, when the aim is the distribution of a hypertext and the addresses should not be able to modify it.

With one single button IPERtool allows to print the whole hypertext, a subset of pages or a number of linked pages. In the last case the user can browse the hypertext marking the interesting pages, and the next printing command will have the effect of printing only these pages.

### **2.3 Internet fruition of the educational products**

With IPERtool we overcome the problem of adding networking capabilities to existing local hypertexts [6] and the consequent questions about feasibility (is it easy to add networking as an afterthought to an existing hypertext system?), authorship transparency (can networking be added without authors having to change their existing hyperdocuments?) and readership transparency (can networking be added without changing the way readers use the hypertext system?).

The reason is that IPERtool is designed on purpose to produce hyperdocuments that are usable both in a local environment (Personal Computer with MSWindows) and in a networked one (Personal Computer with Internet connection and a WWW browser).

Every hypertext written using IPERtool can be viewed with Netscape Navigator or similar Internet browser, and it appears indistinguishable with respect to a hypertext written in HTML. The same functionalities (tables, frames, forms...) implemented in Netscape Navigator are available, and the format of the included pictures, sounds and movies is the same. Also the hypertext keyword management is accessible using a simple built-in form-based interface.

An advantage with respect to hypertext written in HTML is that the whole hypertext is contained in a single file, and the distribution is consequently easier.

### **2.4 Compatibility with other hypertext formats**

The compatibility with other document formats is important in the light of the reuse of information, and in many case teachers have a great deal of didactic material already prepared.

IPERtool has an internal translator which permits the inclusion of hypertexts written using the Windows Help or HTML. In these cases not only the content of the nodes is maintained, but also the structure of links and keywords. Besides that, the inclusion of ASCII text or already written Word for Windows documents is possible and immediate.

Furthermore, IPERtool can export either in HTML or in RTF, choosing whether to include or not the link information.

In a hypertext written with IPERtool users can include references to standard Internet URLs (for example links to external HTML pages); on the reverse, a standard HTML page can include links to a specified page into an IPERtool hypertext.

These characteristics make the integration of already structured information easy, and the reuse of already written documents and hyperdocuments immediate. A general view of IPERtool import/export capabilities is shown in *Figure 1*.

### **2.5 Automatic, reliable, secure publishing of hypertexts**

The process of publishing in Internet the hypertext written with IPERtool is completely transparent both to the author and to the Webmaster of the WWW server.

Once IPERtool is correctly installed on the Internet server, the only think the author has to do after she has finished with the hypertext is to choose an item on a menu and digit username and password; the hypertext is transferred into her home directory without the intervention of the Webmaster, and without the risk of corrupting other authors' hypertexts. User authentication is provided with a simple MD5 based challenge-response mechanism.

Trained system users or system administrators can however transfer manually the hypertext: they have to send via FTP a single file and write a simple HTML anchor to link it to an existing page.

### **3IPER tool**

IPER tool [7] (or, shortly, iPer) is made of four distinct components:

1. *IPERedit*, a WYSIWYG editor that allows the building and maintenance of the hypertext. It is a full visual environment that totally hides to the user the management of the distinct files and media the hypertext is composed of. IPERedit uses a private representation for hypertext (the .AEH file) but it can easily import and export file written both in HTML and in Microsoft Rich Text Format (RTF) [8] using the Windows Help Convention (WinHLP) [9]. HTML pages can be downloaded directly from Internet thanks to a HTTP-browsing capability integrated into the editor.
2. *IPERreader*, a read-only browser to distribute the hypertext over traditional media like diskettes or CD-ROMs: all the browsing capabilities of IPERedit are provided.
3. *IPERserver*, a gateway that allows the browsing of an hypertext in AEH format stored in a standard WWW server by a HTTP connection.
4. *IPERupload*, a server side demon that allows the upload of a hypertext into a WWW server with a simple click of the mouse button. Remote user identity is ensured by a simple MD5-based protocol.

IPERedit and IPERreader have been developed using Borland Delphi, a visual environment that allowed a fast prototyping of the product in the MSWindows environment. IPERedit and IPERreader are fully supported under Windows 3.11, Windows95 and Windows NT 3.5. IPERserver and IPERupload consist of a library of CGI (Common Gateway Interface) scripts developed in C that at present run over Digital UNIX 3.2; they are nevertheless portable over other flavors of UNIX, and over other systems. IPERupload has been easily installed on a SUN to distribute hypertexts to the students at the University of Udine.

Our main goal in developing IPERedit was to help the user not to waste time in taking care of the different files of which a hypertext is made of. The user works all the time with a unique object called *the hypertext* and all the objects inside the hypertext are stored in a single file: this make the distribution and the maintainance of the hypertext extremely simple.

In order to achieve this goal we defined a private binary file format called *AEH* (Advanced Encapsulated Hypertext) that allows the encapsulation of all the object inside the hypertext. While developing this format we strongly kept in mind the need of an easy conversion to and from HTML and RTF formats.

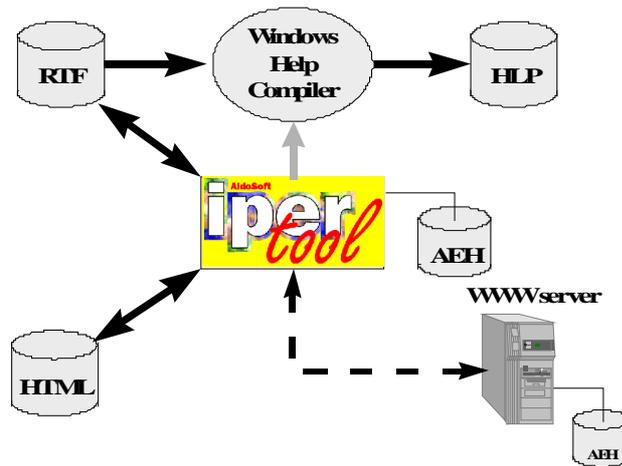


Figure 1: IPERtool, a general view

### 3.1 IPERedit

IPERedit is a WYSIWYG hypertext editor that has two distinct components:

- the *main window* (see Figure 2) provides a whiteboard on which the hypertext is displayed. The menu bar allows the usual operation, such as opening and saving the hypertexts. A toolbar provides hypertext-related functions: in the reader mode it contains only the basic instruments for navigation, while in the editor mode it provides buttons for hypertext import, objects management, keyword management and switching between browsing and editing modes.
- the *toolbar window* (see Figure 3) provides page-related functions such as text and paragraph formatting and tools for inserting and managing objects into the hypertext. The toolbar appears as soon as the user switches from reader mode to editor mode.

An object oriented approach has been followed to manage the variety of elements inside the hypertext. Each complex item (such as images, image maps and links) can be found in the object table and the user can modify its properties at any time. Inside an hypertext you can find the usual objects of a networked hypertext such as images, image maps, tables, frame sets and multimedia players for audio and video. Links can drive to another page in the hypertext, to a standard Internet URL or to executable or compressed files embedded into the hypertext.

Linking objects inside the hypertext is a full visual operation: a window helps to choose from the objects database by giving a preview of the link destination.

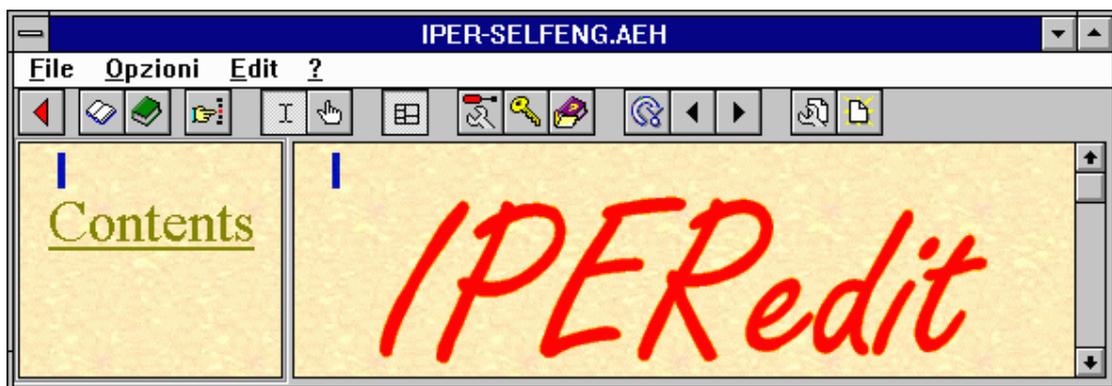


Figure 2: IPERedit, the main window when in editing mode



Figure 3: IPERedit, the toolbar window

### 3.1.1 Keywords Management

To allow a fast and standard way to find information inside the hypertext, IPERedit provides a built-in interface for keywords: for each page storing up to 20 keywords is possible. The user can change and insert keywords using a simple window, and the browsing interface allows the access to keyword database using a two level hierarchy: each keyword belongs to a set, in a way similar to WinHLP.

To access an argument, the reader first chooses a keyword, and then between related topics. Besides that, a global search through the whole hypertext can be performed by a simple search-and-substitute window.

### 3.1.2 Importing and Exporting

IPERedit uses the AEH format to store objects; however, to grant the reusability of material in other formats it can import and export ASCII text, HTML and RTF files, and it can generate WinHLP files invoking the Windows Help Compiler.

By default an ASCII text is included “as it appears” using the IPERtool “pre-formatted text” import capabilities: this is useful in particular to include program source code. The user can format the text in a later time using IPERedit.

HTML importing can be done directly from the Internet via an HTTP connection. IPERedit has a simple HTTP browser interface that allows the importing of an HTML file; the file is converted into AEH format and, switching the editor mode on, can be saved as an AEH hypertext or became part of an existing one. There are some limitations to the import capabilities from HTML: image maps and frame cannot be automatically converted in AEH. Netscape frames are converted according to the NOFRAME tag specifications, while image maps are imported as simple images. Future releases of IPERedit shall support frame and client side image map importing following the Netscape extension to HTML 3.0.

IPERedit can import plain RTF or RTF conform to the Windows Help Compiler specification; both links and keywords will be preserved in the resulting AEH hypertext. Images, that are stored in the RTF as Windows MetaFile (WMF) are replaced by the string “[Image]”. This seems not to be a strong limit because WMF images often need a manual

editing (anti aliasing, color palette changes, and so on) to obtain a GIF or JPEG image of acceptable quality.

On the export side, an export window allows the navigation through the hypertext (showing a little preview of the pages) and permits to choose the order in which pages will be exported. In this way the user can choose his path inside the hypertext and get a copy only of these pages, avoiding the exportation of a page at a time.

The only limitation about exporting to RTF is encountered on nested tables, that are not convertible. In HTML export, AEH image maps are converted into simple images.

IPERedit can export RTF sending it directly to the Windows Help Compiler to generate a WinHLP file in which links and keywords are preserved exactly as in the AEH hypertext. Tests on exporting medium sized hypertext into WinHLP gave quite good results.

A complete view of the import/export capabilities of the IPERtool is given in *Figure 1*.

### 3.2 IPERreader

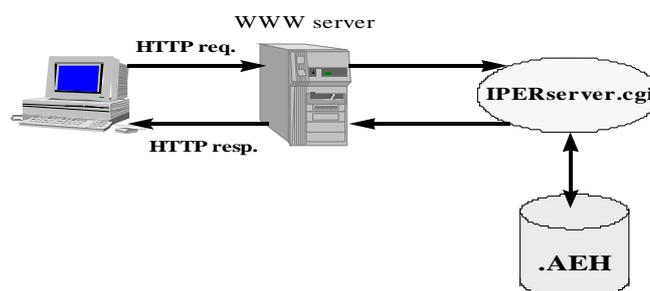
IPERreader is a read-only version of IPERedit. It has been projected to distribute hypertexts in AEH format by traditional means such as diskettes or CDROM. User can browse through the hypertext using the navigation panel and can access to the keywords database. It's possible to make a global search through the keywords or choose directly a keyword between the sets of keyword inserted by the hypertext author. IPERreader acts over the hypertext as the WinHLP interface does.

IPERreader setup information can be customized from the author of the hypertext to display hypertext related information during the installation in a local environment. This allows the distribution of the hypertext together with IPERreader as a single integrated package.

IPERreader can be used as a context-sensitive help interface for MSWindows programs using the Microsoft Dynamic Data Exchange. This allows program developers to use IPERedit as a hypertextual help editor for Windows applications.

### 3.3 IPERserver

IPERserver is a simple Common Gateway Interface (CGI) script that provides on-the-flight conversion from an AEH file to HTML. This makes the AEH files stored into the file system of a WWW server accessible to any HTTP client.



*Figure 4: IPERserver*

As shown in *Figure 4*, each link of the AEH hypertext is translated by IPERserver into a dynamic self-request. This means that by clicking the link, IPERserver is invoked to display

the requested page of the hypertext. Parameters specifying the requested hypertext and page are sent to IPERserver via extra path information, as defined by HTTP 1.0 protocol.

### **3.4IPERupload**

In order to provide an easy way to maintain and distribute hypertexts on WWW we developed a secure CGI front-end to upload AEH files in an hypertext. Through a connection with IPERupload, an authenticated user can upload a new hypertext or modify or delete an existing one. Uploading is as simple action (the click of a button) in the upload window of IPERedit. The only requirement for the user is to have previously and properly configured his profile providing username, password, the remote location of the WWW server and the directory in which the IPERupload CGI is located. IPERedit can be distributed pre-configured for a WWW server so that the user need only to provide username and password. Hypertexts uploaded onto a WWW server are immediately available for distribution over the Internet through the IPERserver gateway.

As we provide a gateway to write on the file system of a WWW server from a remote IPERedit client, we need an authentication framework to protect unwanted accesses to the file system of the server. Each hyperwriter is uniquely identified by a user name, and a password is required to add or overwrite a hypertext stored in a WWW server. The password is never sent in clear over the network, but an MD5 hash of a challenge phrase is used to authenticate the user to the server. This will protect the password from eavesdroppers that could observe packets flow over the Internet.

## **4Applications**

While we are in the process of experimenting IPERtool and of adding new features, we have used it for a number of applications.

A hypertext for teaching the C programming language to students at the first year of a master degree in computer science engineering has been written at Politecnico di Torino using IPERtool. It contains about 2.500 nodes; if it were written in HTML it would have been composed of 2500 different files with the obvious related management problems, but in our case it is only composed of a single file.

This application, under the form of two floppy disks that contain also the IPERtool browser, has been distributed to the students both at Politecnico di Torino and at the University of Udine, and it is available on the Web of Politecnico di Torino.

Besides the educational applications, in order to provide a wide testbed to the IPERtool authoring system, it has been provided to Ph.D. students at Politecnico di Torino to create and maintain their personal home pages.

We are evaluating the feasibility of using IPERtool as the way to provide real time update to the official courses program of our University, allowing direct access to the courses description hypertext for the teachers of Politecnico di Torino.

## **5Conclusion and future work**

The experimentation of the various features of IPERtool will give us a report of the positive and negative characteristics of the tool. We are in particular interested in the reaction of hypertext authors with no computer science background to see if IPERtool is as easy to use as we intended it to be.

Future work is also directed to provide full compatibility in import/export HTML 3.0 Netscape extensions and to solve minor bugs related to table management. To provide an higher level of security in writing the WWW server file system, a public key based authentication framework will replace the actual based on MD5.

## 6 REFERENCES

- [1] J. Conklin, "Hypertext: an Introduction and Survey", *IEEE Computer*, 20(9):17-41, September 1987.
- [2] J. Nielsen, "Hypertext and Hypermedia", Academic Press, San Diego, CA, 1990.
- [3] L. Farinetti, A. R. Scarafiotti, "Conoscenza e comunicazione in ipertesti per la didattica" (tr. Knowledge and communication in educational hypertexts), in *Sistemi Intelligenti*, VII, 2, 1995, pp. 291-303.
- [4] L. Farinetti, A. R. Scarafiotti, "Hypermedia in education: lots of theory and a little of practice", in *Proceedings of ED-MEDIA 95, World Conference on Educational Multimedia and Hypermedia*, Graz, Austria, June 1995.
- [5] L. Farinetti, A. R. Scarafiotti, "Hypercalculus: will students be completely satisfied with our hypertext, one day?", in *Proceedings of ED-MEDIA 96, World Conference on Educational Multimedia and Hypermedia*, Boston, MA, June 1996.
- [6] P. Brown, "Adding networking to hypertext: can it be done transparently?", in *Proceedings of ECHT '94, ACM European Conference on Hypermedia Technology*, Edinburgh, UK, September 1994.
- [7] A. Ghigliano, "IPER tool, a Technical Guide",  
[http://www.polito.it/iper/tech\\_help.html](http://www.polito.it/iper/tech_help.html)
- [8] "Rich Text Format (RTF) Specification - v. 1.3", MS Product Support Services Application Notes, January 1994.
- [9] "Microsoft Windows Software Development Kit: Programmer's Reference",  
*Volume 2* Microsoft