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A Comparison of WWW and Hyper-G

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Abstract: In this paper we attempt to compare features of WWW and Hyper-G, the first fully operable networked multimedia system that goes much beyond WWW and incorporates many features first proposed in Xanadu and later partially tested in systems such as Intermedia.

Key Words: Hypermedia, Hyper-G, WWW, Xanadu, networked information systems, Internet

Categories: H.5.1

1 Introduction

Although WWW has become a major buzz word in connection with the Information Superhighway it was originally designed for limited size information system applications. As it is being used for more and more diverse and large efforts it is become increasingly clear that more powerful tools are necessary.

Although not yet as widely known, one such tool has emerged in 1995 that deserves attention: its compatibility with WWW combined with a more sophisticated architecture and many desperately needed features is making Hyper-G one of the obvious candidates to take over where WWW reaches its limits.

This paper is an attempt to present a comparison between the two systems and indicate why we believe WWW is less suitable for large or complex applications.

2 Data Representation

2.1 Text

a) The native text representation format for WWW is HTML, which is evolving through a series of official versions (1.0, 2.0 and now 3.0) 3and a range of of proprietary extensions implemented in browsers from companies such as IBM, Microsoft and Netscape. Hyper-G uses HTF (Hyper Text Format) and HTML. Both HTML and HTF are applications of SGML.
HTML and HTF have many similarities, although HTF has more powerful hyperlinks which may overlap while HTML has forms for user interaction and is being extended with a variety of interesting presentation facilities. Neither is suitable for scientific publishing, as they do not support the advanced type control necessary to present formulae, resulting in many authors currently resorting to inline images of the desired typography! HTML 3.0 will support mathematical notation.

b) Other text formats: both WWW and Hyper-G servers can support a variety of other text formats which can then be presented by viewing software either integrated into the browser or externally invoked as a "helper application". The existing native Hyper-G browsers already support Postscript (and can support hyperlinks on the Postscript documents). Internal support for Adobe PDF (Portable Document Format) and HTML in the Hyper-G browsers is in development.
c) The future: WWW is firmly committed to HTML, with gradual adoption of HTML 3.0 as the standard begins to coalesce although additional proprietary tags will no doubt continue to complicate the issue, perhaps to be included in later revisions of the HTML standard.
Hyper-G will add HTML 3.0 support by the end of 1995, including tables, forms and CGI (Common Gateway Interface) scripts, thus providing full compatibility with WWW.

2.2 Other Data

a) Both WWW and Hyper-G servers and viewers support images in GIF and JPEG format, both inline and as documents in their own right.
b) Both WWW and Hyper-G servers and viewers support audio and video clips. There is no mechanism to support hyperlinks within audio and video objects in WWW. Only the entire media object can be a link destination. Hyper-G permits links to and from sections of audio and video objects.
c) 3D scenes are supported in both WWW and Hyper-G using the VRML standard.

3 Data Structures

3.1 Basic Units

WWW: documents; Hyper-G: clusters of documents which are intended to be presented simultaneously or represent the same information in different forms, for example in different languages. The WWW concept is a special case of the Hyper-G version when a cluster contains only one document.

3.2 Structuring of Documents

WWW: no structuring beyond (uni)directional links; thus, a WWW database has no well-defined document groupings other than the server filesystem directory structure, which is therefore often used to define the scope for searches and access authorisation. This requires considerable planning and maintenance of the server filesystem layout.

Hyper-G: bi-directional links; clusters have attributes (that can be searched on) and are grouped into collections. Collections can themselves be members of other collections, and may belong to more than one parent collection; thus, Hyper-G provides two orthogonal structuring paradigms, elements of a relational database and hence a variety of access techniques.

4 Link Philosophy

4.1 Basic Links

WWW: links are uni-directional and embedded into documents. They can be attatched to text or images, but not to other media. The destination is generally an entire document but may also be a position within the document or (with some servers) a byte range within a document.

Hyper-G: links are bi-visible and bi-followable, stored in a separate link database, can be associated with any part of text, image, audio and video material and can have as destination a collection, a document or part of a document.

Hyper-G is more flexible in its link concept: the bi-visibility makes it possible to determine all documents pointing to any given document (particularly important for database maintenance!); keeping links in a separate server database from the documents allows users to add their own private links even to documents they do not own ("construction of private views and customization"); links to no longer existing documents can be easily removed; source and destination anchors in Hyper-G are generalisations of the WWW concept.

4.2 Forms and Clickable Imagemaps

WWW supports forms that can be filled out and "clickable imagemaps". In clickable imagemaps a cursor position can be returned and used in an arbitrary program. Since Hyper-G inherently supports source anchors for links on regions of an image, it can provide the same functionality without additional programming at the server. This is similar to the new "USEMAP" HTML tag which defines the image regions for the browser. Hyper-G will also support HTML forms.

5 Server Philosophy

5.1 Network of Servers vs. Distributed Database

WWW: Users access one server at a time and switch from server to server using a "stateless" protocol. Each document request generates a separate connection to the server where that document is stored, possibly via a proxy server.

Hyper-G: Users access one server and through that server all others, unless explicitly overruled. This makes it much easier to generate statistics on user navigation through the server.

The Hyper-G approach allows extensive caching: when 100 persons access, through a local Hyper-G server X, a picture from a remote server Y that picture will be transfered from Y to X only a single time; in WWW the picture will be transmitted from Y to each of the 100 persons unless those persons all point their clients to a proxy server with caching running. The Hyper-G server-server protocol also ensures cache consistency, which is a difficult issue with WWW proxy caches.

The fixed connection approach of Hyper-G has one potential drawback: suppose a New Yorker accesses a Hyper-G server in Paris and finds a link there to another New York server. In WWW selecting this link by-passes Paris immediately; in Hyper-G the user has to explicitly disconnect with the Paris server if

the "detour" is considered undesirable. It may, however, be desirable since billing services and disciplined use of the Internet become easier using this Hyper-G approach.

5.2 Integration of Other Servers

WWW provides a common Gateway Interface (CGI) to integrate external applications; a similar interface has been announced for Hyper-G. SQL gateways (Oracle, Sybase, etc.) have also been implemented for Hyper-G.

5.3 Searching

WWW has no built-in search facility. Some WWW servers such as WN do have built in searching, and most allow third-party search engines such as WAIS or GLIMPSE to be added. However, this requires additional configuration and is implemented differently (if at all) on each site.

There are also various search engines that index documents from as many WWW servers as possible, such as Lycos, Webcrawler and Excite. However, these indexes are built by programs which laboriously "crawl" around the WWW following links to discover documents, and thus often contain many documents which no longer exist or have been moved. Many documents are not indexed because they have not been discovered by the program.

Hyper-G has a built-in search facility: as search scope a union of collections (even distributed over geographically distant servers) can be specified. Attribute, title and full-text searches are supported.

5.4 Platforms

WWW servers are available from CERN, NCSA, NetScape, and others. Most platforms are supported.

Hyper-G servers are available under UNIX (including Linux) and have been announced for Windows NT. Hyper-G is freely available, and maintenance contracts for commercial users are provided. Sources are available but have to be licensed for commercial usage.

5.5 Security

"Secure" servers are available from NCSA (S-HTTP) and Netscape (SSL and S-HTTP). Hyper-G has pledged to follow the NCSA approach to provide authentication, security and privacy, and to have additonal billing possibilities.

Hyper-G offers two ways for billing information right now: a "subscription" approach based on passwords and a "limited number of users at a time" licensing technique.

5.6 Annotations

In Hyper-G users can "annotate" documents (by adding their own linked documents), and annotations can themselves be annotated. Since viewers support the annotation process this provides for an asynchronous computer conferencing feature not available in WWW (where the embedded link concept does not allow this kind of annotation).

5.7 "Local" Database

A "local" server that allows previously downloaded documents to be viewed is available in rudimentary form for Netscape. A powerful version has been announced for Hyper-G. Thus, parts of Hyper-G databases can be directly transferred to CD-ROM. The ED-MEDIA'95 proceedings available under <http://hyperg.iicm.tu-graz.ac.at/electronic_library> is one example: it is available in exactly the same form also on a CD.

6 Clients and Interoperability

6.1 Clients

A host of WWW clients are available on the PC, Mac and Unix platforms. The best known are NCSA Mosaic and Netscape. The latter has achieved some 70% market share within the last six months. Netscape is easy to install and to use, fast, and offers a number of features like access to Newsgroups and FTP that other viewers (including Hyper-G viewers) are still lacking.

For Hyper-G there is the "Terminal Viewer" HGTV, a simple text-based viewer and editor for all platforms, the fancy X-Windows viewer Harmony and the MS-Windows viewer Amadeus. Both Harmony and Amadeus have navigational features going beyond WWW clients (see 6.2. below) and can be used as powerful structure-editing tools. A particularly easy to use "one-window" viewer for Hyper-G under MS-Windows is in preparation. A Mac viewer is also under development.

6.2 Navigational Features

All clients (WWW and Hyper-G) provide basic navigational facilities like "back", "history", "bookmark", clicking on a link, etc. The extent of navigational facilities depends also on the server. Hence, Hyper-G viewers give "location feedback" (showing where users are within the collections of Hyper-G), a "local map" (showing in- and outgoing links, currently only supported by Harmony) and "3D Information landscapes" (Harmony only). Navigational features for Hyper-G even with WWW clients include search facilities and "go to parents of current collection": these features are provided to non-Hyper-G clients in the Hyper-G WWW gateway.

6.3 Interoperability

All WWW viewers allow access to Hyper-G servers (and profit in this case from some of Hyper-G's functionality). Conversely, all Hyper-G viewers allow access to all WWW servers. Note that 100% compatibility even between WWW clients is impossible as long as HTML 3.0 is not universally accepted as standard.

However, it is important to understand that the choice of viewer is independent of the choice of server.

7 Penetration and Developments

WWW has literally exploded during the last 2 years. Numbers vary, but some 20,000 servers are installed, albeit the vast majority containing not more then a few pages. Hyper-G (server and Harmony viewer) was released in January 95, causing some ripples. By mid 1995, over 100 Hyper-G servers are installed with remarkable growth. WWW is better suited for small applications, but Hyper-G is the only viable alternative for large databases when WWW (without much "propping up") tends to break down.

Some main players at the moment are:

(1) NCSA working on server and client (Mosaic) development.

(2) IICM/IHM Graz working on Hyper-G.

(3) Netscape working on Netscape servers and clients.

(4) University of Minnesota working on the next generation Gopher system.

(5) CERN, the original home of WWW, working on standardisation, particularly of HTML 3.0.

(6) INRIA, which just has entered the arena to take over some of the work CERN has previously been doing.

The W3 Consortium, headed by MIT with INRIA its European partner, is trying to channel new developments; and so is the recently formed Web Society (see <http://info.websoc.at/>), where members of IICM/IHM Graz, UMN, CERN and INRIA have become directors, with NCSA potentially to follow. The directors of the Web Society (in contrast to W3C) must come from non-profit organisations.

NCSA, IICM/IHM Graz, UMN, and CERN are in close coordination to assure interoperability on the viewer level now and in the future; they will also try to join forces with INRIA.

As a first cooperative venture a VRML Viewer has recently been jointly announced by NCSA, IICM/IHM Graz and UMN. These organisations have also agreed on further joint development work on future integrated Internet tools combining the best of Gopher, WWW, and Hyper-G.

The IICM/IHM Graz and UMN are cooperating closely on the client side and on providing Gopher users an upgrade path to Hyper-G.

A Hyper-G consortium has been formed. Details can be found at <hyperg://hyperg.hgc.org/> or <http://www.hgc.org/>.

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