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Collaborating Over the Web: Libraries and Laboratories or The Librarian and the Webmaster

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Disclaimer

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or

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Introduction

Fermilab [HREF1] has been using World Wide Web [HREF2] (WWW) servers and browsers for the past several years. The purpose has been to allow information sharing within internationally dispersed teams of large collaborations of high energy physics experimenters and to make possible the easy dissemination of information by support groups who work with those collaborations.[3] That is, the purpose has been in fact that for which WWW was created at CERN [HREF3] beginning in March 1989. See (Berners-Lee *et. al.*, 1992 and 1994).

In early 1992, Ruth Pordes and Jonathan Streets of the Fermilab Computing Division's [HREF4] Online Systems Department [HREF5] (OLS) were considering the problem of providing information about online data acquisition systems to high energy physics experimenters. Seeing the WWW presentation to Artificial Intelligence in High Energy Physics (IHEP'92) at La Londe, France in February 1992, Streets recommended WWW as being "the best thing around," and OLS decided to adopt it.[4]

A server to provide online data acquisition system documents [HREF6] was set up by Tim Berners-Lee [HREF7], CERN , and Jonathan Streets, Fermilab, on a visit by Berners-Lee to Fermilab in July 1992. Tim Berners-Lee went on to visit NCSA [HREF8], the National Center for Supercomputing Applications in Urbana, Illinois beginning the collaboration whose result was NCSA Mosaic for Mac [HREF9], PC [HREF10], and X (Unix) [HREF11].

That first server ran on a VAX/VMS system and used DCL (Digital Command Language) in its implementation. In response to browser requests, it extracted full text documents from a previously existing Fermilab-written document database[5]. This 1992 technology would be considered fairly primitive by today's standards. Using a revised implementation, the server continues in operation today.

July 1992 through January 1994 saw the creation of an estimated ten to fifteen servers by various groups associated with Fermilab. Some, such as E781 [HREF12], were created by experimenters to help organize the dispersal of information within their far-flung collaborations; others, such as the Sloan Digital Sky Survey [HREF13] were created by Fermilab support groups to help with the development of software and hardware intended for a particular project.

In February 1994, it became clear that WWW was gaining a real presence at the laboratory and that an actual Fermilab Home Page [HREF14] was needed to bring together the servers created by the "early adopters" as well as set the stage for further use of the web technology. Initially, a process involving consultation with a broad set of relevant groups was imagined. However, the impending announcement of evidence for the top quark [HREF15] made it imperative to have the home page up quickly[6]. Instead, a small team drawn from the Fermilab Directorate and Computing Division was charged to accomplish the task. Beginning with a concept authored by Judy Jackson, Fermilab Directorate, and Liz Quigg, Fermilab Computing Division, an implementation was put in place by the date of the announcement on April 28, 1994. The Laboratory continues to add additional links to its

home page and to update it with significant announcements–the most notable one being the announcement of the discovery of the top quark [HREF16] posted on March 2, 1995.

Just prior to the April 1994 date, the Fermilab Library, knowing the intense interest of its readers in the scientific papers concerning the evidence of the CDF [HREF17] and D0 [HREF18] collaboration, set up a Fermilab Library web server [HREF19] in order to provide references to the top quark papers. The Library continues to extend and enhance its server with reference offerings as well as information about the Library.

In the months since, the Laboratory and Library servers have evolved in distinctly different ways. An effective collaboration between the librarian and the webmaster has occurred. Some information has been listed on both servers. In other cases, the choice has been made not to list the item on one or the other. A certain intentional complementarity and dissonance of approach has evolved. Looking back, we have come to realize that this process has been valuable and stimulating to the evolution of both servers and may hold a key to the way other organizations may wish to orchestrate their web offerings.

In the remainder of this paper, we describe the architecture of the Laboratory and Library servers, discuss the goals, the implications of those goals, the drivers of structure and content, and the effect of these factors on the architecture. Comparisons are made. The implications for Libraries within organizations are described. The application to large Libraries which begin to have multiple servers within their own organization (e.g., one in reference, one in cataloging, one in circulation) is made. The broader implications are discussed.

Laboratory Web Architecture

The laboratory web architecture had to be created in a way that succinctly grandfathered the existing servers. The individuals who created these servers were actively using the web to further significant national and international collaborations, such as the Sloan Digital Sky Survey [HREF20] and the DART [HREF21] (Data Acquisition for fixed target Real Time) projects. In addition, they possessed much of the knowledge and lore concerning the server and browser software. Thus, whatever the "architectural rules," the rules had to let these collaborations go forward and not require wholesale reorganizations of servers.

Goals and Implications

There were a number of goals in creating a laboratory web architecture and in setting up the Fermilab home page. Years of experience with the laboratory were very helpful in suggesting matters to consider.

Goals for the overall organization were:

1. Whatever the scheme, it was crucial that it be easily adaptable to new situations.
2. It had to work in a decentralized fashion (basically in order to achieve Goal 1); yet it needed to provide laboratory management with the necessary control.
3. The decision processes involved in listing new servers had to be quick in the ordinary "same as three previous servers" situations but allow for careful consideration in unusual, totally new types of server listing requests.

Goals for the home page itself were:

1. As the laboratory's "electronic front door," the home page should be presentable and "spiffy".
2. The home page should provide information appropriate for an audience with a wide and varied background. It should do this without impeding the use of WWW for the scientific, support, and technical collaboration purposes for which it was invented.
3. The home page should point to other Fermilab WWW servers for the benefit of outsiders.
4. The home page should point to a limited number of non-Fermilab servers of high interest to Fermilab insiders.

Some implications of these goals were:

1. A high performance computer platform with high uptime was chosen. Login access was restricted to maintainers only. The existing net news server turned out to be the appropriate choice.

2. An effort was made to structure the home page so that the "tourist" sections about Science of High Energy Physics [HREF22] and the Laboratory as a Research Institution [HREF23] would draw the visitor naturally into material appropriate for them while researchers and technical personnel could quickly move past these sections into more technical material (in the Fermilab At Work [HREF24] section).

3. The pages, particularly in the Fermilab At Work [HREF25] section, have evolved into something of an information directory. (This is in some ways analogous to the "community information" catalogs that are often provided by libraries along with their automation systems.)

4. The list of pointers to high interest, non-Fermilab servers has been limited to information very focused on the laboratory's mission. It has not become a "meta-page," one with extensive and continually growing lists of references to other servers. Instead, the referenced servers are those that contain information associated with the laboratory's mission in a very mainstream way.

Content and Structural Drivers

There were a number of drivers of content and structure in the construction of the Fermilab Home Page during February - April 1994.

The role of the Laboratory Directorate had to be recognized:

The role of the Laboratory Directorate in shaping the presentation of the laboratory to the external community had to be recognized. That this should be a consideration with respect to World Wide Web seems obvious now because of the web's clear public presence.

A year before the setting up of the Fermilab Home Page, however, the web was simply a device for technical communications between an experiment's collaborators[7] with little, if any, visibility to the external community. The growing public presence of the web meant that creators of web servers had to accommodate themselves to the Directorate's beginning to play a role and the Directorate had to educate itself about the importance of the web as a significant vehicle for presentation of the laboratory to the public.

Result: An individual within the Directorate who already had certain responsibilities for media relations was designated as Editor of the top level page and those pages designed for the general public. An individual from the Computing Division was designated Editor of the technical pages– these being Fermilab At Work [HREF26], and its related links.

A relatively flexible procedure involving e-mail consultation between the two Editors and the webmaster was set up to coordinate proposals for changing the home page. See the United States Department of Energy Televideo Service [HREF27] home page for a *much* more structured approach in this area.

The role of the web in the life of experiments and their support had to be recognized:

By April 1994, the web was inextricably linked into the way a number of experiments conducted their collaborative activities. Experiments had clearly found the web to be an effective communication tool to further the research process. Support groups came to similar conclusions. It was very important to foster this use of the web–after all, not only was the support of collaborative high energy physics research the reason the web was invented but it was (and is) one of the main purposes underlying Fermilab.

Experiment web pages truly describe "work in progress"–unpublished, unrefereed material inappropriate to be cited outside the collaboration. Support groups similarly use the web for provisional matters.

The concept of a "work in progress" area became clear. What made this concept particularly useful was that "work in progress" was a sensible disclaimer generally understood by many–not only individuals involved in research but also those associated with funding agencies supporting that research.

Result: The Fermilab At Work [HREF28] section assumed a prominent role in the web offering.

Fermilab is very much a "laboratory without walls" and has operated in this fashion since its beginning in 1967. Those who have contemplated the "library without walls" concept will understand the unique challenges such a structure brings. A member of the Fermilab research community may be anywhere–on the laboratory site, at the college just down the street or at a university in Australia.

It would have been impractical and administratively very costly to restrict access to the "work in progress" collection of pages at an overall level. Indeed, it would have had a chilling effect on collaborative work. Restriction by browser IP address would not have worked because of varied individual researcher affinities. Usernames and passwords would not have worked because of the dynamic way individuals move in and out of collaborations.

Collaborations that wish to isolate the more sensitive areas, such as minutes of collaboration meetings, particularly controversial results, etc., *do* make use of access restrictions. It is easy for specific collaborations to employ these techniques because they, with their knowledge of the collaboration, are able to manage access much more easily.

The role of the home page in presenting information to the public had to be recognized:

In April 1994, the web was rapidly taking on a public presence. Fermilab's major funding agency, the United States Department of Energy [HREF29] was setting up a home page. The White House [HREF30] was rumored to be coming up with one.

Result: As with any public information channel, it was important to have appropriate structures set up to allow the laboratory speak clearly and with one voice. The designation of the editor, based out of the Directorate, addressed that matter. By design, the "public voice" of the laboratory could be presented in the top level page and the pages designed for the general public while work in progress could be described in the Fermilab At Work [HREF31] section.

The relationship between the home page and technical publication had to be clarified:

The status of information presented on the home page (and related pages) had to be clarified with respect to whether or not its presentation constituted technical publication.

Result: The matter was deferred. No area on the home page was *formally* designated as a publication area.

There are clearly documents within the Fermilab At Work [HREF32] section that are nearing publication. However, they are regarded as either (a) work in progress, (b) in support of that work, or (c) material presented in the spirit of inviting "community refereeing," additional collaborative work or co-development. A particularly good example of the latter is the Fermilab Software Tools Program [HREF33].

To address the deferral, a collaboration between the Fermilab Publications Office, Library, and Computing Division was set up to work through the issues. A number of items (varied input formats, the need for patent and copyright review as well as peer review) make this a complex task. Once accomplished, a Publications Fileserver will be put in place. Authors will be able to submit their papers and readers will be able to obtain publications–all over the web.

The varied view points of those browsing home page had to be addressed:

Result: Within the top level page and the pages designed for the general public, this was addressed by including material at different levels of technical sophistication.

Within the Fermilab At Work [HREF34] page and related pages, the approach of providing different access points was followed–borrowing here from library organizational techniques.

Many people simply want to access what is new. Others know the laboratory organization chart and wish to find their material via that route. Others still know the name of the experiment or large scale project. Others simply know the general category of information. Finally, others want a very focused guide to external web resources with some "jumping-off" points to broader "meta-page" guides.

All these access methods are provided but without elaborate page structure. Duplication under each access method, if it serves the reader, is allowed. Since screen real estate is at a premium and short load time is very desirable (this is, after all, a list for those *at work.*), simplicity is the rule: the structure is that of a simple list indented as appropriate.

Effect of Drivers

Fermilab top level page and immediate subsidiary pages:

The effects were:

1. The home page tended to be more static and less easy to change.
2. There were more severe strictures on form and content of the top level and second level pages.
3. There was more sign-off required to make a change to any of these pages.

These were intentional and desired. A technology which achieves prominence as a communications channel to a large general audience needs to be managed carefully and in a fashion that is consistent with the organization's overall direction. In addition, as people have come to depend upon the pages for information as part of their regular everyday activities, stability and familiarity have become important–particularly at the top page levels.

Collaboration and Support Group pages:

The main effect was that collaborations and support groups were asked to designate a "local webmaster" as a prerequisite to having their web server listed as a link off the Fermilab home page (e.g., in the Fermilab Experiments & Projects portion of the Fermilab At Work [HREF35] page).

This "local webmaster" is expected to be a contact with whom the Fermilab webmaster could discuss technical issues (e.g., server down, change of server node, etc.). The local webmaster is also expected to make sure that the server content is consistent with various proper computing usage policies. A distinction is made between collaboration/support-group "institutional" pages and home pages for individuals. The "local webmaster" is held responsible for the content of the "institutional" pages. The individuals are held to conformance with proper computing usage policies in the content of their home pages. When setting up the individual's home page, the local webmaster is expected to remind individuals about these policies which they have seen before at the time they received their computer account.

An element of "line management responsibility" was put in place by requiring the local webmaster's supervisor (or official spokesperson in the case of collaborations) sign a form designating the particular individual as local webmaster. In addition, a supervisor is strongly encouraged to obtain the blessing of their Division or Section head in order to make sure there is a clear understanding at a high level about what is being done.

Consequences:

With respect to the top level pages, the consequences have been favorable. The structure has held up over the year since the Fermilab Home Page was created and seems to have served its purposes well.

With respect to the collaboration/support group pages and servers, there has been a modest amount of comment about the sign-off bureaucracy. This has been weathered. The delegation of responsibility for content to an accountable, recognizable line management chain has given management (and certainly the webmaster) a certain comfort level in linking independent servers to the Fermilab Home Page.

At least in one circumstance, the arrangement worked well when a particular content was questioned. Thus, the procedure appears to work and, most importantly, the collaborative use of the web and web servers at Fermilab appears to be healthy, on-going, and adopted in greater and greater numbers.

Library Web Architecture

Overview:

With a staff of six the Fermilab Library is responsible for the information and research needs of some 700 scientists and another 2,000 laboratory employees. There is a collection of 15,000 book volumes, subscriptions to 250 journals, and a weekly receipt of approximately 200 preprints. Preprints, research papers which are circulated among the high energy physics community worldwide, are the most important part of the Library's collection. Preprints in paper format are diminishing. They were one of the first sources to move to full-text online format.

When a library's major collection changes formats, focus on access must shift. The typical Fermilab Library reader is highly literate in electronic media and in turn has high expectations in regard to information access and delivery. At the same time preprints were migrating to such places as the xxx e-Print archive [HREF36] at Los Alamos National Laboratory [HREF37] and to any of a number of other preprint bulletin boards [HREF38] as well as onto WWW servers of specific research individuals and groups, more and more information sources were also becoming available via the web. Through its own single web server [HREF39], the Library was able to direct its readers not only to WWW resources, but also to gopher, ftp and telnet sites. WWW has become a common denominator in this high energy physics setting as a way of making active references to information sources.

Goals and their Implications

Immediacy of access to information resources:

Since many documents of interest to the high energy physics community are now being generated on web servers, web access is often the quickest and most efficient means of retrieval. The choice of a web server over a gopher server or ftp access was based on the following:

1. the natural affinity between the web and high energy physics research
2. the ease of server implementation
3. the growing web infrastructure in the Laboratory
4. the flexibility of the URL structure allowing for connections not only to other WWW servers, but also to gopher, telnet, ftp sites.

Relevancy, both in content and format, to reader and laboratory information needs:

In order to achieve and maintain relevancy to reader needs the Library's web offerings are fluid in design and change according to reader demand, both actual and anticipated.

With its own server, the Library is free to make links, change links, break links, and change the design of the hierarchy of resources–all in conjunction with the ever-changing reader needs. As the maintainer of the Library's web server, the head librarian incorporates new web resources discovered by means of listservs, library literature, library and laboratory colleagues. Most of these are placed under the "Hot Links" [HREF40] section of the Library's home page.

Centralization and marketing of Library resources:

The Library home page brings access to diverse resources together in one place. It is a "clickable" library brochure which, moreover, can always be current. Since automating the Library's catalog in 1990, the idea had been to customize the automation system to be the platform for jumping off to other databases and resources.[8] The Library home page has in fact become that "jumping off" point. The automation system, the principal repository of bibliographic and holdings information, is now coming to be thought of as just another information source among those provided by the Library. The web is what is bringing them all together.

Empowerment of the Library staff to author their own web information sources:

The Library server was installed on a Macintosh already in place in the Library. This was familiar territory for the librarian which increased the probability of the server's success. In addition, the experience the librarian gained in writing HTML documents and navigating the web made it possible for the Library to become one of the organizations in the Laboratory that could provide information, guidance, and mentoring on WWW, HTML, and URL's. Most of the Library's web offerings are links to other servers rather than original documents, but this of course reflects the referral nature of library services.

Content and Structural Drivers

Reader Interest:

Distinctive from the Laboratory web server, the factors driving the content and structure of the Library server are much more closely tied to reader interests and needs. Setting up of the Library web server in April 1994 was motivated by reader need to gain access to two preprints which presented evidence of the existence of the top quark, the (then) last, remaining, yet to be discovered quark in the Standard Model theory linking all sub-atomic constituents.

Links to the full-text of these two preprints were the first ones the librarian added to the Library server's "Hot Links." Also handling most of the reference queries, the librarian increasingly turned to WWW first in tracking down government documents such as Presidential press releases and science policy statements requested by the Laboratory's Director and other readers. Good URL "finds" generated from this work were often times incorporated into the Library's "Hot Links" [HREF41] section.

Organizing the web:

When found on the web, links were quickly incorporated into the Library's server often "bumping down" or replacing older links. For example, links to the "top quark evidence" preprints were moved down the Hot Links list as reader interest waned. Now those first links have been removed altogether and replaced by links to the top quark discovery papers [HREF42] by the CDF and D0 collaborations. Again, when significant documents concerning governmental support of science were released, links were added. Two examples here are the U.S. White House report, "Science in the National Interest," [HREF43] and the Drell Report [HREF44] issued by the U.S. Department of Energy on the future of high energy physics. As these documents became less topical, links were removed.

The frequency of the changes is an element of the chosen architecture for the Library's web server: reader-driven change.

Hardware/Software Availability:

As previously noted, the Library server runs on existing Mac hardware. The MacHTTP server and MacMosaic browser software was downloaded from the National Center for Supercomputing Applications [HREF45] (NCSA) in Urbana, Illinois. The easy installation obviated lengthy searches for staff resources that would have been necessary had the software been more difficult to install.

Implications for Libraries and Library Administrators

Involvement of the Library Staff in the Web Architecture

Make Sure there is an Understanding of Basic Concepts:

With a conceptual understanding of the fundamentals of web architecture, library staff can build the confidence needed to maximize their use and in turn the readers' use of web sources. Involvement in the initial period of setting up web server and browser, as well as many other technological tools, provides a sense of "owning" that technology which often motivates future participation in such projects.

Encourage Interaction between Librarian Staff and Computing Professionals:

In the spirit of collaboration, interaction between library staff and computer professionals can foster exchange of ideas and mutual professional respect. The potential for a successful web service is heightened when technology is combined with understandings of usage patterns and needed content. The library staff know their web users–their readers–and their ways of getting from one topic to another. The library staff need to participate in designing the links and other architecture for the web server so that readers will find the linkages natural.

Support the Provision of Continuous Training and Access to Developments in Technology:

Support from library administrators of continuous training programs for library staff along with the provision of hardware, software, network upgrades, etc., is imperative. Library staff will have to have the tools, the training, and the time to experiment with expanding technology and electronic information sources.

New Face of Library Services

Library services have a new face brought on by the new technological capabilities. The pace of development is so fast that one must plan while implementing and implement while planning.

The focus in this paper has been Reference Services but changes are occuring in other service areas as well. It is entirely possible to imagine multiple web servers within a large library–some devoted to circulation (e.g., to support reader access to his/her own circulation records), technical services (e.g., to provide information on recently cataloged materials), and reference (e.g., to provide access to "Hot Topics" pages maintained by individual reference specialists for their particular specialty fields). Indeed, a number of libraries already are making innovative uses of web technology along the lines described.

See for example, Innovative Internet Applications in Libraries [HREF46] maintained by Ken Middleton of Todd Library, Middle Tennessee State University and also Fisher Library at the University of Sydney [HREF47].

When a library begins to have multiple servers with multiple collections of pages maintained independently by varied individuals across the institution, the web organization issues begin to resemble those for a large laboratory, such as Fermilab. It may be that the solutions described here will also apply.

New Role for Libraries within Institutions and Communities

The work of librarians as information specialists has suddenly become popular within our culture. However, the general populace does not necessarily associate librarians with the rise of electronic information. The need for consciousness raising about the library profession has never been greater. The doors are open to librarians to step in as their institution's or community's mentors for Internet access and tools such as WWW.

The ease of gathering and authoring via the web empowers librarians with a greater independence and flexibility. As a result, they will be able to change their library's public interface at a pace more in step with reader needs instead of being so highly dependent on vendors, computer professionals, or others.

The Next Phase of Library Automation

With web technology, systems centered around a single vendor or single information provider give way to a reader-centered collection of many systems and information resources accessible over the network. The unique aspect about the web development has been the *ease* of access along with the *quickness* of switching from one information source to another.

The web's "Uniform Resource Locator" (URL) concept is key to making this ability to switch quickly possible as is, of course, the underlying presence of that uniformly accessible, totally interconnected, network of networks, which is the Internet. Together, the two provide a seamless interface to these varied information resources, bringing on the next phase of library automation by creating what one might call the information marketplace.

Of course, the information marketplace has existed for a long time–the pivotal aspect of this new information marketplace is that the point of purchase has changed. Formerly, the decision to go with this or that commerical database vendor was likely made in the library administrator's office once a year at contract time. Now, the decision is made by the individual reader as he or she chooses this or that network information resource on possibly a minute to minute basis.

Currently, in the "spirit of the internet," there are many "vendors" supplying information for free. Given the ease of authoring and making documents available on the web, this may continue for some time. Still, the demand for authoritative documents or those with other special characteristics accessible in the same way as the free material is giving rise to vendors who provide access to information resources on the network for a price.

Vendors naturally work to have their resources made essential and placed at the center. Special browsers, special servers, or other software that use the underlying web and network transmission rules are all possible. Regardless of what vendors devise for providing access to their information over and above the basic Mosaic browser kinds of capabilities, libraries must require conformance to standards and mandate interoperability (e.g., require that information servers from various vendors work with a wide selection of information browsers).

Not only will this force competition into the information marketplace, encouraging high quality and low price, but it will also allow the library to stay "light on its feet" and very adaptable to the highly diverse, growing numbers of information resources on the Internet.

By so doing, libraries will insure that they, in the next phase of automation (which in fact is now occuring), can continue to be reader-centered rather than system-centered and thereby be of maximum benefit to their reader communities.

Broader Implications

The web architecture within an organization is shaped by many different drivers. The institution's top-level web server is likely to be very structured while the library's web structure, particularly in the reference area, needs to be flexible, dynamic, and responsive to reader interest. The democratization of information authoring and access which the web supports makes it possible to bring many more people into the process of information distribution and access.

Conclusion

The advent of World Wide Web has brought together diverse, formerly distant parts of the Laboratory. Suddenly, press officers, publications specialists, patent lawyers, librarians, and researchers are finding the focus of their work to be just a mouse click away from one another. In collaboration, the Library and the Laboratory have devised a web architecture which makes information accessible to readers while respecting the policies of funding agencies, the sensibilities of authors, and the concerns of other information stakeholders.

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HREF3 http://www.cern.ch - CERN

HREF4 http://fnnews.fnal.gov/cd/ - Computing Division

HREF5 Online Systems Department - http://www-ols.fnal.gov:8000

HREF6 http://fnala.fnal.gov:8000/docdb - Server to provide online data acquisition system documents

HREF7 http://www.w3.org/hypertext/WWW/People/Berners-Lee-Bio.html - Tim Berners-Lee

HREF8 http://www.ncsa.uiuc.edu/ - NCSA

HREF9 http://www.ncsa.uiuc.edu/SDG/Software/Brochure/MacSoftDesc.html#MacMosaic - NCSA MacMosaic

HREF10 http://www.ncsa.uiuc.edu/SDG/Software/Brochure/PCSoftDesc.html#WinMosaicNCSA - WinMosaic

HREF11 http://www.ncsa.uiuc.edu/SDG/Software/Brochure/UNIXSoftDesc.html#XMosaic - NCSA XMosaic

HREF12 http://fn781a.fnal.gov - E781

HREF13 http://www-sdss.fnal.gov:8000/ - The Sloan Digital Sky Survey

HREF14 http://www.fnal.gov - Fermilab

HREF15 http://www.fnal.gov/top_news_release94.html - Announcement of evidence for the top quark

HREF16 http://www.fnal.gov/top95/top_news_release.html - Announcement of evidence for the top quark

HREF17 http://www-cdf.fnal.gov - CDF

HREF18 http://d0sgi0.fnal.gov - D0

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HREF37 http://www.lanl.gov/ - Los Alamos National Laboratory

HREF38 http://libmc1.fnal.gov/Hot.html - relevant preprint bulletin boards

HREF39 http://libmc1.fnal.gov - the Fermilab Library's web server

HREF40 http://libmc1.fnal.gov/Hot.html - "Hot Links" on the Fermilab Library web server

HREF41 http://libmc1.fnal.gov/Hot.html - "Hot Links" on the Fermilab Library web server

HREF42 http://www.fnal.gov/top95/top_discovery.html - links to the top quark discovery papers

HREF43 http://docs.whitehouse.gov/white-house-publications/1994/08/1994-08-03-science-in-the-national-interest-policy-statement.text - "Science in the National Interest"

HREF44 http://www.hep.net/documents/drell/full_report.html - Drell Report

HREF45 http://www.ncsa.uiuc.edu - National Center for Supercomputing Applications

HREF46 http://frank.mtsu.edu/~kmiddlet/libweb/innovate.html - Innovative Internet Applications in Libraries [HREF46]

HREF47 http://www.library.usyd.edu.au - Fisher Library at the University of Sydney

Footnotes

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* Note: Double underlined words in the paper version of the document indicate the hypertext references in the network-resident version of the paper submitted to the conference. For the network-resident version, see the URL: http://www.scu.edu.au/ausweb95/papers/libraries/garrett/

For information more generally about the conference, see the URL: http://www.scu.edu.au/ausweb95/

This document was prepared with MicroSoft Word and converted to HTML for the network-resident version using rtftohtml. For further information, see ftp://ftp.cray.com/src/WWWstuff/RTF/rtftohtml_overview.html.

1 Head Librarian, Fermi National Accelerator Laboratory, January 1987 - March 1995.

2 Webmaster, Fermi National Accelerator Laboratory.

3 T. Berners-Lee, Presentation given at Fermilab, July 1992 (unpublished).

4 J. Streets, private communication.

5 Penelope Constanta-Fanourakis, Guide to Using the Document Database - DOCDB, PN 336, March 29, 1988, (unpublished).

6 The top quark is the last to be discovered quark in the Standard Model theory linking all sub-atomic constituents. Researchers have searched for it in physics experiments for some eighteen years. In April 1994, evidence for it was announced by the Fermilab CDF and D0 Collaborations. In March 1995, CDF and D0 announced its discovery.

7 For example, in March 1993, one experiment's private unpublished meeting minutes requested collaborators to store material in the experiment's VAX Notes electronic "conference," a vendor-specific, platform-specific, system somewhat like a bulletin board. By June 1993, the experiment's minutes had announced V1.0 of the experiment's "Documentation System," a WWW Server and implied the demise of VAX Notes. The sense in the announcement was that merely of setting up another channel of collaboration communication–of little relevance to the laboratory Directorate and the laboratory's public posture.

8 P. Garrett and D. Ritichie, "Fermilab Library Projects," FERMILAB-TM-1667 (1990) and P. Garrett and D. Ritchie, "Fermilab Library Directions," FERMILAB-TM-1668 (1990).