The Operational Reality of the Net in April, 1996: How do Software Companies use the Internet and Intranet?

by
Edward H. Schadler

B.A., Physics
Swarthmore College, 1981

M.S., Computer Science
University of Maryland, College Park, 1989

Submitted to the Alfred P. Sloan School of Management
and the School of Engineering
in Partial Fulfillment of the Requirements for the Degree of

Master of Science in the Management of Technology
at the

Massachusetts Institute of Technology

June, 1996

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Signature of Author: ____________________________________________
Edward H. Schadler
17 May 1996

Certified by: ____________________________________________________
Michael Cusumano, Thesis Supervisor
Associate Professor, Sloan School of Management

Accepted by: ____________________________________________________
Rochelle Weichman, Director
Management of Technology Program
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ABSTRACT

The Internet and Intranet appear to be innovative and potentially important tools to help businesses manage their operations. But the popular press and the stock price of firms specializing in Internet technologies do not give an accurate picture of how useful these technologies actually are.

This thesis helps counter the great enthusiasm for the new technology with a survey on how eighty of the largest U.S. software companies use the Internet and Intranet in managing their business operations.

The survey results confirm that firms are finding the Internet to be a very important part of the way in which they market themselves, though a somewhat less important way to support customers, distribute products, research vendors, and recruit employees. Companies are using their Intranets for everything from video conferencing to employee benefits management.

Thesis Supervisor: Michael Cusumano, Associate Professor, Sloan School of Management

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The Operational Reality of the Net in April, 1996: How Do Software Firms Use the Internet and Intranet?
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Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>4</td>
</tr>
<tr>
<td>Methodology</td>
<td>8</td>
</tr>
<tr>
<td>Survey</td>
<td>18</td>
</tr>
<tr>
<td>Results</td>
<td>23</td>
</tr>
<tr>
<td>Executive Summary</td>
<td>35</td>
</tr>
<tr>
<td>References</td>
<td>36</td>
</tr>
<tr>
<td>Interesting Links</td>
<td>38</td>
</tr>
<tr>
<td>Thoughts on Digital Publishing</td>
<td>42</td>
</tr>
<tr>
<td>Charts</td>
<td>51</td>
</tr>
</tbody>
</table>

This thesis is submitted as one of the requirements for a Masters Degree in the Management of Technology at the MIT Sloan School of Management.
Introduction:
The Hope, the Hype, and the Hard Numbers

A Word on Lexicon

- The Internet describes a global network of networks running TCP/IP. The World Wide Web or Web or WWW uses HTTP (Hypertext Transfer Protocol) to share information on the Internet. Intranets use TCP/IP and HTTP on a network that is restricted to a company's employees (and sometimes customers and suppliers). I will tend to use the Web or the Net to include any and all three of these concepts.

Author's Notes

- The hyperlink structure in this document is not what is usually seen on the Web. Because of a requirement to print this thesis on paper and submit it for credit, all externally referenced URLs (Uniform Resource Locators) are given explicitly.

- All self-referential hyperlinks use the Web common usage of showing the underlined link, but without showing the URL.

Setting the Stage

For those of you reading this thesis in a time other than Spring, 1996, the idea of a survey on how the Net is used may strike you as odd, unnecessary, naive...or possibly prescient. The Net is probably so ubiquitous that it no longer has a name. It's just "the way we do things." Let me therefore place this survey in the context of April, 1996.

The Internet, which has been used by colleges and universities for the better part of two decades, explodes onto the international scene in 1994 (or 1992 depending on who you ask) with the advent of the World Wide Web. In the U.S., the Internet is all Wall Street, Main Street, or anybody else can talk about.

- Magazines about the Web, both on paper and on-line, spring into existence.

- Email becomes a preferred way to conduct personal, professional, and even romantic communication.

- Weddings (including my own) are planned via the Internet.
• *Emoticon*, a sequence of characters ;-)) to show emotion in character-based email messages, becomes a new English word. Web snobs turn their nose up at this pedantic display of character-based emotion, opting instead for emotive cartoon expression images.

• There is much talk about cyber-this and cyber-that. The more philosophically inclined say the "Web is a solution looking for a problem." However, it appears there is no shortage of problems...

• People start putting the URLs of their *homepages* on their business cards (in April, 1996, mine was [http://web.mit.edu/schadler/www](http://web.mit.edu/schadler/www)).

• The stock of some companies specializing in Internet technologies trade at 100 times revenues. (That's revenues, not earnings!)

• Cities and countries create *Websites* to promote themselves and provide information of local interest (movie times and dining reviews, for example).

• *Cybercafés* offering coffee, Web access, and virtual games begin springing up and going public.

• The 1995 Telecommunications Act blackens websites around the U.S. as netizens protest the restriction of free speech by changing the background of the websites to black. Congress and the U.S. Courts struggle to understand the Internet. China tries to control the Internet.

• *Phil Zimmerman's Pretty Good Privacy (PGP)* ([http://web.mit.edu/network/pgp.html](http://web.mit.edu/network/pgp.html)) is declared by the U.S. government to be a "munition," and is banned from export. A case concerning encryption begins winding its way through the U.S. Federal Court system. (Of course, it's tough to prevent the sharing of information, including encryption algorithms, when a global network is available.)

• Every big consumer and most non-consumer companies establish web presences to promote their products and services.

• Increasing quantities of government information are put up on the Web. Even tax forms are available on the Web.

• There is talk in Washington about using Federal might to enable every household in the U.S. to have access to the Internet. The Net is seen as a critical success factor for the future of the country.

• Internet shopping breaks down international barriers and introduces customs
nightmares for companies finding themselves selling products globally.

- A generation of entrepreneurs converges on Silicon Valley, Cambridge, MA, and countless other regions to build thousands of Internet-based companies. The smart money buys firms with markets and builds alliances.

- Hollywood discovers the Web as a place to promote movies and the Net as a force of evil in storylines.

- At first, daring advertisers put their URLs in print or TV ads, then seemingly overnight every corporation in America is plugging their URL. People don't know what "URL" stands for, but they sure know what it means.

- The difference between hype, hope, and hard reality is so blurred as to be non-existence.

- In 1995, the controversial CommerceNet/Nielsen Internet survey[^1] declares that 37 million people in the U.S. and Canada over the age of 16 have access to the Internet. A group at Vanderbilt University disputes this figure.[^2]

- An extrapolation of the Internet growth curve predicts that by the year 2010, the entire planet will be connected. This may be true in your time, but in 1996, two-thirds of the planet's people don't even have a telephone in their home.

__________________________

So with mass hysteria infecting Wall Street and Main Street, it doesn't seem so silly to conduct an academically sound, demographically useful survey of how the Net is used by companies. This thesis is that survey. It is a stake in the ground to hold one corner of the billowing Internet tent down with some hard data from companies that are selected by their very presence on the World Wide Web. The thesis itself consists of

- This introduction,
- the Methodology behind the survey,
- the Survey itself,
- the survey Results,
- Executive Summary,
- References

There are some relevant (and even interesting) appendices:

- Interesting Links to other websites
- Thoughts on Digital Publishing
Methodology: There is method to this madness...

- Getting started
  - The goal
  - Considering the alternatives
  - Researching the population
  - Identifying the target

- The survey sample
  - The sample
  - The risks
  - The benefits

- Performing the survey
  - Scoping the terrain
  - Choosing the questions
  - Learning the technology
  - Testing and refining the survey
  - Deploying the survey

Getting Started

Getting started was certainly the hardest part of this project. Once the key decisions were made, the work unfolded in a straightforward fashion. The creative effort was in choosing which path to begin walking down.

The goal

The goal is to collect significant data on how software companies are using the Internet and their Intranets in their business operations. This data is a firm measure of how a specific population, large software firms, perceive the value of the Internet and their Intranet.

This goal was chosen after much thrashing around. I wished to write a thesis that dealt with innovation in some interesting way. I considered topics as diverse as the 1996 Republican National Convention as an example of a Lean Enterprise and the extraordinary rents earned by innovative financial instruments before settling on this more familiar (to me) and populist topic. On a more detailed level, this goal begs a number of questions.
Why software companies (and not other companies)? Why Internet and Intranet (and not information technology in general)? What constitutes "significant" data. These questions are addressed in the next few sections.

---

Considering the alternatives

Once the goal was established, the next challenge was choosing the sample [Blankenship, 1993] [Brightman, 1986] to something manageable in the context of a Master's thesis. Many possibilities were considered:

- Target OpenMarket's commercial sites index (Web presence irrespective of industry, which actually expands the population considerably). [http://www.directory.net/]
- Try to gain compliance from all of the fifty largest software firms.
- Restrict the sample to only those software companies with Internet or Intranet products (by searching through industry magazines).

In the end, I decided that restricting the population to software companies would lend a simplicity and consistency to the results, that trying to get compliance from all fifty largest software firms would likely result in failure, and that restricting the survey to only those companies with Internet or Intranet products would create too powerful a selection bias to make the results broadly useful.

The sample surveyed was the 200 largest software firms with a Web site. This restriction made the survey distribution much easier and had the added benefit of bringing the consistency of probable lead users to the target respondents.

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Researching the population

The sample was chosen from the largest U.S. software firms as ranked by the most recent available data, 1995 revenues. [Ward, 1996] At the time the list of firms was drawn (about March 1, 1996), with reasonable on-line researching of up to five minutes per search, 300 firms were examined to find 200 firms with a Web presence. The firms' annual revenues ranged from $6 billion to $20 million.

It became clear along the way that many of the "missing" firms had been absorbed by other firms in a classic consolidation or "transitional" phase [Utterback, 1994, pp. 92-95]. Most of the search engines and directories listed in the Links section were used in this search process.
Identifying the target

There was one more very important decision to be made: who to send the survey to. Software companies are typically organized in whatever random way their founder invented. Titles and responsibilities vary greatly from firm to firm. One of the challenges in soliciting information from software companies is identifying who should be asked which questions. The marketing department should have the best perspective on the marketing-related questions; the support department on support; etc. As I wished to ask a broad range of questions related to the Internet and not restrict the questions to only one function, the issue of who to ask was problematic.

The problem was compounded by the sample. The larger a firm, the more distributed is its decision-making process and the less aware its employees are of each other's activities.

This problem was solved (or at least tamed with consistency) by targeting the person at each firm identified as the coordination point for Internet implementation, the Webmaster. Webmaster is a gender-non-specific title given to the person responsible for maintaining a company's web presence. During the Spring of 1996, the responsibilities of the Webmaster were changing rapidly. Some Webmasters came from Marketing, some from Software Development, some were hired from outside. Some companies hired a creative firm (like an Advertising Agency) to create and maintain their websites. In all cases, the target had to fit three criteria:

1. Be an employee of the software firm (not a consultant)
2. Be designated as responsible for the Website
3. Have an email address

The survey sample

This thesis was written written in Hypertext Markup Language (HTML) [http://www.w3.org/pub/WWW/MarkUp/html-spec/html-spec_toc.html]; for publication on the Web. Data was collected on the Web and distributed on the Web. The process of researching and writing the thesis revealed some interesting issues that merit recording: (1) How is information best presented in a Hypertext environment? and (2) What barriers exist when publishing information digitally? These issues must have been challenges in the sample firms' adoption of the Net. Exploring these issues in this thesis will hopefully bring some meta-sense of what the firms had to cope with. The ideas are explored in the Thoughts on Digital Publishing section.
The sample

The target sample is simple: the 200 largest U.S. software firms (as ranked by the most recent available data, 1995 revenues) [Ward, 1996] with a Web presence.

What factors are important in assessing how relevant this sample is for other businesses? In other words, how important is the selection bias imposed by the selection process to the interpretation of the results?

Software firms were chosen because their businesses seem to be most enhanced by a global network. The business of software is largely concerned with creating, manipulating, and sharing information. The Net is a convenient infrastructure for these same tasks. Further, only software firms with a Web presence were selected. This restriction makes it even more likely that the survey results will reflect leading-edge practices.

It is tempting to characterize the sample as lead-user [von Hippel, 1995] firms, but it is more accurate to think of the sample as early-adopters of Web technology.

Lead user or early adopter, the point is that this class of firms is (at least anecdotally) making more extensive use of the Web than most other types of firms.

There are of course risks associated with interpreting the practices of early adopter firms too broadly. And some benefits, too. The risks and benefits of surveying software firms with a Web presence are explored in turn.

The risks

The Bleeding-Edge Risk: One risk is that these software companies might be sprinting down a box canyon, destined to be trapped by the rising walls. They might be adopting a technology that will never be accepted at large. This bleeding edge risk is well known to users of new products or services or technologies of any kind. Businesses fail or succeed on their ability to choose technologies that are widely accepted. Choosing correctly gives the business a leading-edge advantage; choosing incorrectly gives the firm a bleeding-edge wound. With technology changing ever more rapidly, bleeding-edge risk must be recognized and managed.

Firms that use these survey results might suffer from two bleeding-edge risks:

1. There is a risk that early adoption of the Web might result in an investment that is not supported by common practice.
2. There is an additional risk that the particular way in which the Web has been used by software firms may not be the way that firms in other industries should use it.
The industries may differ in fundamental ways.

The Narrow-Minded Risk: The narrow-minded risk is that pursuit of one technology will blind a firm to a different and perhaps more successful technology. Many software firms (WordPerfect, for example) are now sorry that they narrowly pursued the DOS market and initially ignored the Windows market. Any time a bet is made on a technology and significant resources are committed, a narrow-minded risk is being taken. This is especially true in so revolutionary a technology as the World Wide Web.

The benefits

The Early-Adopter Benefit: The benefits of being an early adopter or first mover of a successful technology can be vast and all-encompassing. This benefit compels firms to make bets on technology. Those firms that bet successfully will reap the rewards of leadership; those that don't bet or make poor bets succumb to competition.

The Business Efficiency Benefit: The Web is not being embraced solely for its catchy graphics and gee-whiz newness. It is being adopted for the very real efficiencies it brings to the operation of a business. Unfortunately, this survey does not ask this very interesting question, but it is certain that the cross-platform consistency, ease of use, and universal deployability are key benefits of adopting Web technology. As one respondent noted, "the Web unites Macs, PCs, and UNIX workstations, and gives universal access to project and company information."

Competition is ever-more fierce as our global economy introduces ever-more competitors. Advantage, even fleeting advantage, is critical to success. Utilizing new channels for communication, relationship management, and sales is a huge benefit.

Performing the survey

Performing the survey required the majority of labor in this thesis. From start to finish, this process consumed six months and about 250 hours. It hardly seems possible in retrospect that this relatively small amount of information could have required so much labor, but the learning process is never predictable. Many false leads were followed while searching for the best path.

Scoping the terrain

Before even sitting down to come up with a list of interesting questions, I had to get a feel
for the current state-of-the-art. My background is in software development with a small company that builds client/server software applications for the Mental Healthcare Industry. In my role as Director of Software Development and a member of the Management Team, I had a very local and also a somewhat more global perspective on how companies use information technology to perform business tasks. But the Internet and Intranets, and in particular, the Web, bring a different ease and flexibility to the distributed environment, and I wanted to expand my awareness. To do so I used the following information sources:

- Extensive reading of the popular industry literature (Infoworld, PC Magazine, Datamation, InfoWeek) and business literature (The Economist, the Wall Street Journal, BusinessWeek).
- Discussions with contacts in the software industry, and the network that these contacts initiated (see the Acknowledgements part of the References section).
- Web exploration (about 100 hours over eight months), including other on-line surveys, most performed by companies in search of information about the people who visited their websites.

Choosing the questions

Once the terrain and the important issues of the day were clear, a list of target questions was drawn up. Because of the way in which the sample was chosen and the wide-spread availability of Internet technology, there was a risk of asking questions that would not be interesting to the sample and also of asking questions that were too detailed to be of interest to a broader audience. With these two risks in mind, a list of 25 questions was created and distributed to the before-mentioned contacts for criticism.

The questions fell into two broad categories, Internet and Intranet. The Internet questions focused on the importance of the Internet for the business in Marketing, Customer Support, Software Distribution, Vendor Contacts, and Recruiting; the Intranet questions asked if companies are using their Intranet for Collaboration, Communication, and Information applications.

The Internet questions used a modified Likert scale [Judd, 1991, page 163] to ask how important the company (not the Webmaster as an individual) thinks the Internet is for various company functions. The question was asked in this way (rather than simply asking for usage) because of the leading-edge nature of Web technology. It was decided that the risk of people extending "important" into unrealistic "hope" was worth the benefit of getting the company's goals rather than its current reality.

A default "Unsure" response was included to minimize errant answers. Radio buttons (where only one correct response is allowed for each question) were used for selecting the
level, and the Unsure response was pre-checked. The scale follows:

1. Very unimportant
2. Unimportant
3. Might be important
4. Important
5. Very important

The Internet sub-categories were as follows. Note that the questions say "Internet" but imply World Wide Web as the most obvious and widely useful environment. The questions in each category are suggested by the following thoughts.

Marketing
Most media attention and most Web sites have focused on presenting the company to the world, a marketing function. But marketing is a multi-dimensional responsibility, from giving information about the company to understanding what it is customers and potential customers need. What other marketing issues might the Web be important for addressing?

Customer Support
Another popular use of the Net is to answer customer’s frequently asked questions (FAQs). In what other ways might the Net be used to provide customer support?

Software Distribution
Many firms are providing their products on the Internet (Microsoft projects that 16% of its software will be downloaded off the Web in 1996, and Intuit sells state tax programs on the Web). How important is this trend?

Vendor Contacts
As other firms establish web presences, finding and maintaining vendor contacts should be increasingly important (one of the most important innovations of the Web will be the new ways in which companies can cooperate). Is this true?

Recruiting
The Recruiting category included only one question about how important the Internet was for finding new employees.

The Intranet was an even newer phenomenon when work on this thesis began (though it progressed tremendously during the time the thesis was under development). Intranets were being used for a huge variety of applications, many of them "homegrown." Rather than ask how important the Intranet was for certain tasks, it was decided that it would be more important at this point in time to find out what kinds of applications were being used on a company’s Intranet.
The Intranet questions were divided into three categories:

Collaboration Applications
Collaboration applications, including Groupware, are greatly enabled by Intranet technology. Though collaboration applications (except for Lotus Notes, which does not require Intranet technology) are in their infancy, these applications are potentially most enhanced by an Intranet.

Communication Applications
Communication applications, primarily email, have been a driving force behind networks in general. But additional capabilities, including video conferencing, are starting to appear on Intranets.

Information Applications
Information applications are the most varied, with the longest history on corporate networks. What an Intranet brings to this arena is platform independence and inexpensive extension beyond the local network.

Learning the technology

After considering the options for distributing the survey (telephone interview, hard-copy mailed, email, and World Wide Web), the Web was chosen as the easiest, most convenient, and also the most interesting. Because each member of the sample had a Web site, it seemed logical that the Web would be accessible to each company, especially to the Webmaster. Since I had already decided to publish the thesis on the Web, it was similarly logical to deploy the survey on the Web.

Of course, Web documents use HTML so there was a technology to learn. Although every software tools company was rushing a WYSIWYG HTML page authoring tool onto the market, I felt that learning the nuts and bolts of HTML would be useful. Fortunately, HTML is very simple, and with a little bit of attention paid to the use of white space and to page layout, creating the survey in HTML was straightforward. (I used a text editor to write the HTML document and Netscape Navigator 2.0 to view the results.)

The first draft of the survey was, however, embarrassing in retrospect. I knew that the respondents would be busy Web professionals. Creating a survey that would appeal to their aesthetic sense and also be clear and easy to answer was very important. Using HTML Tables (not universally available in early 1996) to organize the questions and radio-button responses was the breakthrough. More than one respondent complemented the innovative use of radio buttons in tabular format.

The survey was submitted using a CGI (Common Gateway Interface) script available at
MIT to implement comment forms. This technology also had to be mastered and implemented.

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**Testing and refining the survey**

Once the survey was written and available on the Web, I reached the same sources that helped me come up with a list of interesting questions and asked them for critical feedback. In all, about a dozen people, some with industry experience and some with artistic bent, contributed to the content and the presentation. Their contributions greatly improved both the quality and appearance of the survey. However, all errors, miscalculations, and shortcomings are my responsibility.

| Author's Note: Web presentation is like any other visual medium -- taste matters. Though the thesis is mostly black text on a dull grey background, the survey is more artistically presented. Finding a presentation that looks attractive in a wide variety of browsers on a wide variety of display devices requires a judicious use of color and form. |

There were, of course, some bugs in the survey that the testing process revealed. These bugs were fixed before deploying the survey. This process of beta-testing a software product (as a Web page and response form surely are) is very well known in the software business, but is clearly also an important part of a successful Web implementation.

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**Deploying the survey**

The survey was deployed on MIT's Athena network on the Ides of March, 1996. Separately addressed email messages (text below) were sent to all 200 Webmasters. The responses were emailed back to me by the CGI form. A few respondents requested an email version of the survey, which follows exactly the same template as the Web version. (Nobody chose the telephone version.) Within a week over 40 Webmasters had responded. Subsequent messages with the same tenor of cooperation in return from information increased the response number to 80, a response rate of 40%.
Dear Web Manager:

Thank you for a moment of your valuable time.

I am a Master's student at the MIT Sloan School of Management writing a Web-published thesis on how the world's largest software companies use the Internet and Intranet. About 5 minutes of your time filling out a Web-based survey will put a stake in the ground for ourselves and for our children.

In return I will send you (if you choose) the survey results and/or a reminder to check out the survey results on the Web.

Survey URL:

If Web Access is difficult or annoying, I can send you the survey via email or by phone (mail to schadler@mit.edu for these options).

Thanks!!

Ted Schadler
MIT Sloan School of Management
http://web.mit.edu/schadler/www
schadler@mit.edu

Though the Web has been popular for less than two years, already the culture of free stuff and hacker generosity has given way to weariness and wariness. People need to get something in return for their time. I felt the promise of collected information from a specific industry would be enough to convince people to participate. Although the response has been excellent from all perspectives, I was aiming for a 50% response rate. I rejected such ploys as offering money to a randomly selected respondent, but if I were to do this again, I would find a way to add more value to the survey website, perhaps by collecting a large amount of statistical information about the Internet to make the site more attractive to visit. (The survey links that are included in this thesis were added after the survey was complete.)
The Operational Reality of the Net in April, 1996: How Do Software Firms Use the Internet and Intranet?

What's in it for me?

"Like tap dancing on quicksand," says Carl Goodman [Goodman, 1996]. He was referring to deciding which digital media to put in a museum, but the metaphor applies very well to the current Internet landscape. This thesis is a stake in the ground for those of us living in the Spring of 1996 as well as for our children, and their children, and their children...

With the help of your five minutes of labor, we will pour some concrete or at least throw a rope so the jungle doesn't swallow our tap dancer. And you will get a digital reminder of the meaningful survey results when they're ready.

This survey, part of a Master's thesis in the Management of Technology at the MIT Sloan School of Management, reports on how the largest prepackaged software firms use the Internet and Intranet in their operations. The results will be published on the Web.

Other organizations are encouraged to respond to this survey, and those results will be separately published.

A Few Important Notes:

☐ All survey answers and comments are strictly confidential.

☐ The quality of the survey response will determine the value of the survey results. Please feel free to forward this survey to other experts.

☐ If you would prefer this survey in another format, please use the comment form with your specific request.

☐ Thank You!

Company Information (I need this information to include your results)

Your company:
Your name:
Your email:
Your title:
The Survey

- Internet
  - Marketing
  - Customer Support
  - Software Delivery
  - Vendor Contact
  - Recruiting

- Intranet
  - Collaboration Applications
  - Communication Applications
  - Information Applications
  - Intranet Comments

- Other
  - How Effective is the Internet?
  - Miscellaneous Comments

The Rating Scale

1. Very unimportant
2. Unimportant
3. Might be important
4. Important
5. Very important

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<th>Does your company think the Internet is an important way to:</th>
<th>Unsure</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<td>Deliver product, service, or company information?</td>
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<td>Attract and develop prospects?</td>
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<td>Sell products (Conduct Transactions)?</td>
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<tr>
<td>Stay in touch with customers?</td>
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Customer Support (Internet)
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<td>To answer customer's frequently asked questions?</td>
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<td>For customers to receive individualized support?</td>
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<td>For users to support each other?</td>
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**Software Delivery (Internet)**

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<th>Does your company think the Internet is an important way to:</th>
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<td>Deliver demonstration software?</td>
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<td>Deliver software?</td>
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<td>Deliver software documentation?</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Vendor Contacts (Internet)**

<table>
<thead>
<tr>
<th>Does your company think the Internet is an important way to:</th>
<th>Unsure</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gather vendor information?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communicate with vendors?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Recruiting (Internet)**

<table>
<thead>
<tr>
<th>Does your company think the Internet is an important way to:</th>
<th>Unsure</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attract employees?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Collaboration Applications (Intranet)**
### Communication Applications (Intranet)

<table>
<thead>
<tr>
<th>Does your company use the following communication applications?</th>
<th>Not sure</th>
<th>No</th>
<th>Pilot Program</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Email?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discussion group/chat session?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Audio?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Video?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electronic Data Interchange (EDI)?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Information Applications (Intranet)

<table>
<thead>
<tr>
<th>Does your company use the following information applications?</th>
<th>Not sure</th>
<th>No</th>
<th>Pilot Program</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company internal information?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bulletin Boards?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decision Support Systems (EIS/DSS)?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Help desk?</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Travel booking service?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employee benefits management?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Other Intranet Applications
The Effectiveness Rating Scale

1. Very ineffective
2. Ineffective
3. Might be effective
4. Effective
5. Very effective

Is the Internet Effective?

<table>
<thead>
<tr>
<th>Does your company think the Internet is effective for:</th>
<th>Unsure</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marketing purposes?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Providing customer support?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delivering software?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vendor contacts?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is the Intranet effective?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Miscellaneous Comments

Please keep my comments confidential
You may share comments, but not my name or company name
You may share comments, and please attribute them to me and my company

Please include your company information. Thanks!

Thank you for contributing to this survey. Preliminary results will be available by the middle of April and complete results by 15 May 1996. If you have any questions, comments, or concerns about this survey, please use the comment form below.
Results: The Proof is in the Pudding

- Preparing the data
  - Organizing the data
  - Understanding the survey biases and systematic flaws
    - Selection Bias
    - Non-Response Bias
    - Response Bias
  - Analyzing the respondents

- Consolidated results
  - Internet
    - General Observations
    - The Raw Data
    - Marketing
    - Customer Support
    - Software Delivery
    - Vendor Contact
    - Recruiting
  - Intranet
    - Collaboration Applications
    - Communication Applications
    - Information Applications
  - How Effective is the Internet?

- Intranet Applications

- Respondent Comments

- Suggested Improvements

Preparation the data

Without analysis, all data is cacaphony. Consolidation is the first step in understanding data, but the search for meaning is perpetual.

Organizing the data
The Internet results were summarized and the sample mean and 95% confidence interval of the population mean found. These results are published in the same tabular format as the survey. The "Unsure" responses were excluded from the sample mean and confidence interval calculations. In most cases, the "Unsure" responses are negligible, the only exception (still with less than 10% of the responses) was in the questions about Vendor Contacts.

The 95% confidence interval for the population mean shows the statistical significance of the mean calculation. The large sample (eighty respondents) makes this range quite narrow; for example, it can be predicted with 95% certainty that the mean of the population of large software firms regarding the importance of the Internet for answering customer's FAQs is between 4.1 and 4.5.

The Intranet results were summarized. These data are not as easily analyzed, and a significant flaw in the survey makes the results less applicable to the "Intranet" and more likely to include all intra-company networks.

In both sets of data, bar graphs for each major category were created.

---

Understanding the survey biases and systematic flaws

Any survey has biases of three types: Selection Bias, Non-Response Bias, and Response Bias. This survey suffers from all three of these biases, but in fairly typical and predictable ways.

Selection Bias

The selection bias in a survey is the bias introduced in choosing the sample. This bias was discussed in the Methodology section. It is the responsibility of the reader to decide if a sample of eighty of the largest software firms is of interest.

Non-Response Bias

As with any voluntary survey, this one suffers from a non-response bias. Though every attempt was made to collect data from 100% of the chosen sample, the response rate was 40%. This is a very good response rate, but one that still indicates a non-response bias.

Why might Webmasters choose not to answer the survey? Probably for a variety of reasons.

- People are busy
- There might not have been enough value returned to justify the time required to fill out the survey
out the survey

☐ Firms are afraid to divulge information

☐ Because of the newness of Web technology, a firm may not feel it is ready to
comment on its Web perspective. Confusion might still reign. There is some
evidence of this presented in the Analyzing the Respondents section.

☐ General apathy

☐ Poor targeting of the email solicitation

☐ Embarrassment over a possible lack of commitment to a potentially beneficial
technology.

It is my feeling that non-reponse bias skews the results toward more acceptance of
Internet technology, but I have no evidence to support this. And even if this is true, the
fact that the survey has a built-in early-adopter focus makes the results no less important
for predicting the future.

Of course, if a sample of the non-respondents were to reveal that they don't view the
Internet as important, then the confidence interval would be meaningless. On the other
hand, if the non-respondents feel much the same way as the respondents, then the
confidence interval would be smaller by the square-root of the percentage not responding
(in this case about 20% narrower). This effect is called the finite sample correction.
[Yamane67, p.70]

Response Bias

The response bias is more significant. Despite the testing of the survey by many critical
eyes and people in the software business, the survey still contained some flaws. These
flaws are analyzed in this section.

Vagueness in the Intranet Applications

The section on Intranet Applications does not make clear which technology is being
questioned. Nowhere does the survey state that the questions are specific to TCP/IP
networks or HTTP protocols. Many of the Intranet applications (email, for example)
have been available for years using a variety of technologies. Some respondents
noted that Lotus Notes™ has been the way many of these Intranet applications
have been implemented.

This flaw does not weaken the value of the responses to gauge how significant
companies are finding various internal company applications, but it does undermine
the original intent of testing the penetration of Internet protocols into internal
company networks.

More than one respondent pointed out this flaw, and all who did so said that they
were answering the Intranet questions without regard to the technology.

Discomfort with the word "Important" in the Internet section

Several respondents found fault with the way in which the Internet questions were
Several respondents found fault with the way in which the Internet questions were asked. One respondent noted that his company did not distribute their software via the Internet, but that they themselves received much software from other vendors via the Internet. He therefore challenged how the question regarding how important the company found the Internet for distributing software should be answered.

This "flaw" was actually intended. As stated in the Methodology section, the intent of the Internet questions was to discover the company's goals regarding Internet use rather than the current implementation. Asking how important the Internet is to running the business is intended to discover strategic intent [Hamel, 1989] rather than existing practice. Because of the extremely fluid nature of current Internet technology, this leading-indicator approach is justified (as long as the associated risks are understood).

The leading-edge intent of the word "important" does not address, however, the concern presented by the respondent who received but did not distribute software. My response to this concern is that it does not change the value of the survey as an indicator of how the Internet will be used in company operations.

Some problems with acronyms
Some acronyms (in particular, EDI, DSS, and EIS -- Electronic Data Interchange, Decision Support System, and Executive Information System) were not universally understood. These two questions might be analyzed with this potential confusion in mind (though people didn't overwhelmingly choose the "Unsure" response).

Analyzing the respondents

The sample was the largest U.S. software firms with a Web presence. The respondents represented 40% of these firms from the largest to the smallest. There was no significant clustering by firm size. The job titles of the respondents (remember that the survey notice was sent via email to the Webmasters of these firms) varied as expected. Defining titles somewhat broadly by functional responsibility yields the breakdown given below. The "Other" category includes Presidents and VPs of business units Web evangelists of various sorts.

<table>
<thead>
<tr>
<th>Title (broadly defined)</th>
<th>Count / (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Webmaster</td>
<td>40 / (50%)</td>
</tr>
<tr>
<td>Marketing</td>
<td>18 / (22.5%)</td>
</tr>
<tr>
<td>Developer/Engineer</td>
<td>10 / (12.5%)</td>
</tr>
<tr>
<td>Network Manager</td>
<td>7 / (8.8%)</td>
</tr>
<tr>
<td>Other</td>
<td>5 / (6.3%)</td>
</tr>
</tbody>
</table>
Two points might be drawn from the title breakdown: (1) the consolidation of responsibility for Web services is occurring; (2) there are still a wide variety of people responsible for Web activity.

Although many different functional groups are represented, half the respondents actually answer to the title of Webmaster. However, the remaining 50% are divided among many different functional responsibilities. This speaks to the newness of the responsibility for maintaining a Web presence and possibly to a lack of cohesive strategy regarding the Web.

**Consolidated results**

The consolidated data is presented in tabular form. The counts in each category as well as the sample mean and 95% confidence interval are included.

Color bar charts showing the results can be seen by selecting the chart icon under each consolidated table.

**General Observations**

The most general conclusion to draw from these results is that everybody thinks the Internet is important for business operations and everybody is using the Intranet for key applications. This sounds like a restatement of the obvious, but this time the statement is backed by solid data.

No Internet question received an average score of less than 3.1; most were above 3.5; and many were between 4.0 and 5.0. Thus no answer received a response less than "Might be important," and many were between "Important" and "Very Important."

The Intranet is currently being used for at least 30 major applications, with many sure to come as companies consolidate their computing platforms around TCP/IP and HTTP (as more than one respondent indicated).

There were no correlations of any significance.

Some of the most interesting results are in the comments section.

**The Rating Scale**

1. Very unimportant
2. Unimportant
3. Might be important
3. Might be important
4. Important
5. Very important

The Raw Data

The raw data is available here.

### Marketing (Internet)

<table>
<thead>
<tr>
<th>Does your company think the Internet is an important way to:</th>
<th>Unsure</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Mean</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deliver product, service, or company information?</td>
<td>0%</td>
<td>1.3%</td>
<td>1.3%</td>
<td>7.5%</td>
<td>26.3%</td>
<td>63.8%</td>
<td>4.5</td>
<td>4.3, 4.7</td>
</tr>
<tr>
<td>Attract and develop prospects?</td>
<td>0%</td>
<td>1.3%</td>
<td>1.3%</td>
<td>11.3%</td>
<td>40.0%</td>
<td>46.3%</td>
<td>4.3</td>
<td>4.1, 4.5</td>
</tr>
<tr>
<td>Sell products (Conduct Transactions)?</td>
<td>0%</td>
<td>8.8%</td>
<td>22.5%</td>
<td>28.8%</td>
<td>27.5%</td>
<td>12.5%</td>
<td>3.1</td>
<td>2.9, 3.4</td>
</tr>
<tr>
<td>Stay in touch with customers?</td>
<td>1.3%</td>
<td>1.3%</td>
<td>2.5%</td>
<td>11.3%</td>
<td>33.8%</td>
<td>50.0%</td>
<td>4.3</td>
<td>4.0, 4.5</td>
</tr>
</tbody>
</table>

### Customer Support (Internet)

<table>
<thead>
<tr>
<th>Does your company think the Internet is an important way:</th>
<th>Unsure</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Mean</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>To answer customer's frequently asked questions?</td>
<td>2.5%</td>
<td>0%</td>
<td>2.5%</td>
<td>12.5%</td>
<td>26.3%</td>
<td>56.3%</td>
<td>4.4</td>
<td>4.0, 4.5</td>
</tr>
<tr>
<td>For customers to receive individualized support?</td>
<td>2.5%</td>
<td>2.5%</td>
<td>17.5%</td>
<td>27.5%</td>
<td>23.8%</td>
<td>26.3%</td>
<td>3.6</td>
<td>3.3, 3.8</td>
</tr>
<tr>
<td>For users to support each other?</td>
<td>3.8%</td>
<td>6.3%</td>
<td>22.5%</td>
<td>33.8%</td>
<td>17.5%</td>
<td>16.3%</td>
<td>3.2</td>
<td>2.9, 3.5</td>
</tr>
</tbody>
</table>
### Software Delivery (Internet)

<table>
<thead>
<tr>
<th>Does your company think the Internet is an important way to:</th>
<th>Unsure</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Mean</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deliver demonstration software?</td>
<td>1</td>
<td>5</td>
<td>7</td>
<td>12</td>
<td>26</td>
<td>29</td>
<td>3.8</td>
<td>3.5, 4.1</td>
</tr>
<tr>
<td></td>
<td>1.3%</td>
<td>6.3%</td>
<td>8.8%</td>
<td>15.0%</td>
<td>32.5%</td>
<td>36.3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deliver software?</td>
<td>3</td>
<td>6</td>
<td>11</td>
<td>25</td>
<td>16</td>
<td>19</td>
<td>3.4</td>
<td>3.1, 3.7</td>
</tr>
<tr>
<td></td>
<td>3.8%</td>
<td>7.5%</td>
<td>13.8%</td>
<td>31.3%</td>
<td>20.0%</td>
<td>23.8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deliver software documentation?</td>
<td>3</td>
<td>5</td>
<td>7</td>
<td>1</td>
<td>19</td>
<td>27</td>
<td>3.7</td>
<td>3.4, 4.0</td>
</tr>
<tr>
<td></td>
<td>3.8%</td>
<td>6.3%</td>
<td>8.8%</td>
<td>23.8%</td>
<td>23.8%</td>
<td>33.8%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Vendor Contacts (Internet)

<table>
<thead>
<tr>
<th>Does your company think the Internet is an important way to:</th>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Mean</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gather vendor information?</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>21</td>
<td>28</td>
<td>19</td>
<td>3.8</td>
<td>3.6, 4.0</td>
</tr>
<tr>
<td></td>
<td>7.5%</td>
<td>3.8%</td>
<td>3.8%</td>
<td>26.3%</td>
<td>35.0%</td>
<td>23.8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communicate with vendors?</td>
<td>7</td>
<td>3</td>
<td>7</td>
<td>27</td>
<td>25</td>
<td>11</td>
<td>3.5</td>
<td>3.3, 3.7</td>
</tr>
<tr>
<td></td>
<td>8.8%</td>
<td>3.8%</td>
<td>8.8%</td>
<td>33.8%</td>
<td>31.3%</td>
<td>13.8%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Recruiting Employees (Internet)

<table>
<thead>
<tr>
<th>Does your company think the Internet is an important way to:</th>
<th>Unsure</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Mean</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attract employees?</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>30</td>
<td>23</td>
<td>13</td>
<td>3.4</td>
<td>3.2, 3.7</td>
</tr>
<tr>
<td></td>
<td>2.5%</td>
<td>5.0%</td>
<td>10.0%</td>
<td>37.5%</td>
<td>28.8%</td>
<td>16.3%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Collaboration Applications (Intranet)

<table>
<thead>
<tr>
<th>Does your company use the following collaboration applications?</th>
<th>Not sure</th>
<th>No</th>
<th>Pilot</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groupware?</td>
<td>10</td>
<td>24</td>
<td>14</td>
<td>32</td>
</tr>
<tr>
<td>Project documentation?</td>
<td>16</td>
<td>19</td>
<td>14</td>
<td>31</td>
</tr>
<tr>
<td>Project management?</td>
<td>15</td>
<td>20</td>
<td>11</td>
<td>34</td>
</tr>
<tr>
<td>Database of employee skills or knowledge?</td>
<td>14</td>
<td>37</td>
<td>12</td>
<td>17</td>
</tr>
</tbody>
</table>

### Communication Applications (Intranet)

<table>
<thead>
<tr>
<th>Does your company use the following communication applications?</th>
<th>Not sure</th>
<th>No</th>
<th>Pilot</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Email?</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>77</td>
</tr>
<tr>
<td>Discussion group/chat session?</td>
<td>5</td>
<td>39</td>
<td>4</td>
<td>32</td>
</tr>
<tr>
<td>Audio?</td>
<td>8</td>
<td>55</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>Video?</td>
<td>7</td>
<td>50</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>Electronic Data Interchange (EDI)?</td>
<td>19</td>
<td>37</td>
<td>2</td>
<td>22</td>
</tr>
</tbody>
</table>

### Information Applications (Intranet)
<table>
<thead>
<tr>
<th>Does your company use the following information applications?</th>
<th>Not sure</th>
<th>No</th>
<th>Pilot</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company internal information?</td>
<td>6</td>
<td>8</td>
<td>11</td>
<td>55</td>
</tr>
<tr>
<td>Bulletin Boards?</td>
<td>5</td>
<td>22</td>
<td>6</td>
<td>47</td>
</tr>
<tr>
<td>Decision Support Systems (EIS/DSS)?</td>
<td>11</td>
<td>35</td>
<td>6</td>
<td>28</td>
</tr>
<tr>
<td>Help desk?</td>
<td>10</td>
<td>29</td>
<td>6</td>
<td>35</td>
</tr>
<tr>
<td>Travel booking service?</td>
<td>11</td>
<td>59</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Employee benefits management?</td>
<td>16</td>
<td>43</td>
<td>6</td>
<td>15</td>
</tr>
</tbody>
</table>

**Information applications bar graph (57K)**

### The Effectiveness Rating Scale

1. Very ineffective  
2. Ineffective  
3. Might be effective  
4. Effective  
5. Very effective

**Is the Internet Effective?**

<table>
<thead>
<tr>
<th>Does your company think the Internet is effective for:</th>
<th>Unsure</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Mean</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marketing purposes?</td>
<td>0%</td>
<td>1</td>
<td>2</td>
<td>13</td>
<td>33</td>
<td>31</td>
<td>4.1</td>
<td>3.9, 4.3</td>
</tr>
<tr>
<td>Providing customer support?</td>
<td>0%</td>
<td>1</td>
<td>1</td>
<td>23</td>
<td>32</td>
<td>23</td>
<td>3.9</td>
<td>3.7, 4.1</td>
</tr>
<tr>
<td>Delivering software?</td>
<td>4%</td>
<td>4</td>
<td>7</td>
<td>34</td>
<td>15</td>
<td>16</td>
<td>3.4</td>
<td>3.1, 3.7</td>
</tr>
<tr>
<td>Vendor contacts?</td>
<td>2%</td>
<td>2</td>
<td>9</td>
<td>30</td>
<td>27</td>
<td>10</td>
<td>3.4</td>
<td>3.2, 3.6</td>
</tr>
<tr>
<td>Is the Intranet effective?</td>
<td>14%</td>
<td>3</td>
<td>3</td>
<td>18</td>
<td>25</td>
<td>17</td>
<td>3.8</td>
<td>3.6, 4.0</td>
</tr>
</tbody>
</table>

**Effectiveness bar graph (65K)**
### Intranet Applications

<table>
<thead>
<tr>
<th>Collaboration Applications</th>
<th>Communication Applications</th>
<th>Information Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groupware</td>
<td>Email</td>
<td>Company newsletters</td>
</tr>
<tr>
<td>Project Documentation</td>
<td>Discussion Groups</td>
<td>Department information</td>
</tr>
<tr>
<td>Project Management</td>
<td>Chat Sessions</td>
<td>Database-driven internal information</td>
</tr>
<tr>
<td>Database of Employee Skills</td>
<td>Audio</td>
<td>Customer problem tracking</td>
</tr>
<tr>
<td>Client support-group</td>
<td>Video</td>
<td>Manufacturing defect tracking</td>
</tr>
<tr>
<td>knowledgebases</td>
<td>EDI</td>
<td>Semi-Automated FTP uploads</td>
</tr>
<tr>
<td>Document management</td>
<td></td>
<td>Time recording</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Support call tracking</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Customer tracking</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bug tracking</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Software QA reports</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ISO9000 quality documents</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Technical documentation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Scheduling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vacation scheduling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Help desk</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Travel booking</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bulletin boards</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Employee benefits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Decision support systems</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Employee Training and Certification</td>
</tr>
</tbody>
</table>

### Respondent Comments

Many of the respondents shared comments as part of the survey. The most interesting of these are presented in this section. Some comments were edited to correct grammar and spelling.

- "Our worldwide operations and focus on acquiring technologies through mergers makes the building of our WAN and diverse operating platforms the most..."
challenging aspects of our Intranet currently. I...forsee training and development of standards which will enable simple navigation..."

☐ "We use the Internet to gather customer leads. A customer indicates product interest and his record is stored in a Notes database. We then send the requested information and [use the contact for] future mailing[s]."

☐ "The Internet is becoming very important for support of our product and contact with our customers."

☐ "The Web looks attractive and is used, but e-mail is the real workhorse to get things done and to communicate. Selling on the Web is overrated, at least for us, but it is useful for establishing a presence and initial contacts."

☐ "No one would argue that the Internet (and Intranet) will play a major role in how we do business in the future. However, I can't help but notice that [the] industry is getting credit today for accomplishments that are still a few years away."

☐ "Right now the Internet (Web) is used primarily as a marketing tool, and secondarily as an alternate means of customer support. If net growth continues at current levels, it will become more viable to use it as a medium for software sales, and then delivery."

☐ "...we expect to tie our corporate customer support database into the Web to provide interactive customer services... This will have to evolve over time given the confidentiality issues..."

☐ "The advent of Java will make the Internet (WWW) much more useful to us, for product demonstration, online tutorials, and HTTP-based product documentation."

☐ "I can understand why companies have embraced HTML as a standard for their internal communications. Using standard web browser software, the interface is always the same - regardless of the OS on the server or client desktop. No special training is necessary, keeping things productive."

Suggestions for Improvement

It would be interesting to see this survey deployed more broadly. However, some changes must be made before this is possible.

1. Revisit the decision to use the forward-looking "importance" phrasing on the Internet questions. I still feel that this approach worked well for the lead-user intent of this thesis, but it may not be appropriate for a more broadly distributed survey.
2. The Intranet questions should be more clearly designated as using Web technology (if in fact this is what is desired). Currently the survey does not make clear which (if any) technology is being surveyed.

3. The acronyms should be explained. This is very easy to do given the power of HTML to hyper-reference a glossary.

4. I would find a way to ask more precisely which Intranet products are being used and how important they are. One possibility would be to use an interactive Web form that allows respondents to select Intranet applications from a pull-down list, and encourage "write-in" applications.

Please use the comment form to communicate any questions or suggestions.
Executive Summary

This survey asked the Webmasters of the 200 largest U.S. software firms with a Web site how important they found the Internet for marketing, customer support, software delivery, vendor contacts, and recruiting, and what Intranet applications they were using.

Eighty firms responded with results that confirm the popular media's view that the Internet is important. In marketing, for example, 90% of the respondents felt that the Internet was either very important or important for delivering product, service, or company information. 86% felt the same way about attracting potential customers. 69% felt the same about delivering demonstration software, and 69% felt that the Internet was either very effective or effective for supporting customers.

Virtually all firms are using their Intranet for email, and 83% are using or beginning to use their Intranet to disseminate company information internally. 29% are using or beginning to use their Intranet for video conferencing!

### Internet

<table>
<thead>
<tr>
<th>Category</th>
<th>Summary Data</th>
<th>Bar Graph</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marketing</td>
<td>Data</td>
<td>Bar Graph (49K)</td>
</tr>
<tr>
<td>Customer Support</td>
<td>Data</td>
<td>Bar Graph (50K)</td>
</tr>
<tr>
<td>Software Delivery</td>
<td>Data</td>
<td>Bar Graph (55K)</td>
</tr>
<tr>
<td>Vendor Contacts</td>
<td>Data</td>
<td>Bar Graph (46K)</td>
</tr>
<tr>
<td>Recruiting</td>
<td>Data</td>
<td>Bar Graph (37K)</td>
</tr>
<tr>
<td>Effective</td>
<td>Data</td>
<td>Bar Graph (37K)</td>
</tr>
</tbody>
</table>

### Intranet

<table>
<thead>
<tr>
<th>Category</th>
<th>Summary Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collaboration Applications</td>
<td>Data</td>
</tr>
<tr>
<td>Communication Applications</td>
<td>Data</td>
</tr>
<tr>
<td>Information Applications</td>
<td>Data</td>
</tr>
</tbody>
</table>

Please use the comment form to communicate any questions or suggestions.
References


Acknowledgements

I would like to thank the following people for their contributions to this thesis: Michael Cusumano of the MIT Sloan School for his gentle and constructive critical support; Arnie Barnett of the MIT Sloan School for his serious but never dull perspective on statistics; David Foster of Bachman Information Systems, Dave Oliver of Cadence Design Systems, George Calvert of Echo Management Group, Steve Franck, Gerard Magnin, Peter Quek, and Jeff Thayer of the Sloan School's Management of Technology program, Ara Bernardi of Microsoft Corporation, Gene Stromecki of IBM for their help with the survey; and especially my wife, Deirdre, for her love and support during this intense and exciting year.
Interesting Links

- Other Surveys
- Search Engines
- Directories
- HTML Guides
- Hyperfiction
- Miscellaneous

The links found in this page are relevant in April, 1996. The rapid nature with which links and sites change makes the value of this page minimal over the long-term. Still, one of the seductive qualities of the Web, and one of the ways that people can add value to the Web is to collect, organize, and qualify the myriad sites. So here is my minor attempt to coordinate some relevant or interesting sites.

Other Surveys

  Yahoo maintains an extensive and growing list of Internet surveys.

  SRI 1995 web trends page with other survey links.

- http://fiat.gslis.utexas.edu/~sfawce/pastsurvey.html
  More survey links from the University of Texas.

- http://www.commerce.net/information/surveys/
  The [in]famous CommerceNet/Nielsen survey. The results are disputed by the Project 2000 team at Vanderbilt University.

- http://www.ora.com/survey/
  O'Reilly Research survey on Internet demographics, and a short survey on the number of businesses with an Intranet or Internet presence.

- http://www.cc.gatech.edu/gvu/user_surveys/
  Georgia Tech has performed user surveys since January, 1994.

Search Engines
- http://www.altavista.digital.com/
  I find the AltaVista search engine to be the easiest and fastest to use.

- http://www.excite.com/
  Excite

- http://www.infoseek.com/
  Infoseek

- http://www.lycos.com/
  Lycos, Inc.

- http://www.opentext.com/
  Open Text Corporation

- http://www.webcrawler.com/
  WebCrawler Searching

- http://www.yahoo.com
  Yahoo, one of the most popular search engines and directories

Directories

- http://www.directory.net/
  OpenMarket's Commercial Sites Index

- http://www.commerce.net/directories/
  A collection of directories

- http://www.lib.umich.edu/chhome.html/
  A great collection of directories.

- http://www.e-library.com
  An extensive on-line library with a fixed (and reasonable) pricing structure.

  A list of directories and search engines maintained by the University of Indiana.

- http://info.lib.uh.edu/pr/v6/n1/bail6n1.html

- http://www.w3.org/hypertext/DataSources/bySubject/Virtualibraries/Overview.ht
The W3C maintains a list of virtual libraries, broken down by type of access (browsing, searchable, other).

  A map-driven commercial listing of businesses.

  Nynex's on-line yellow pages.

**HTML Guides**

- [http://www.w3.org/pub/WWW/MarkUp/html-spec/html-spec_toc.html](http://www.w3.org/pub/WWW/MarkUp/html-spec/html-spec_toc.html)  
  The HTML 2.0 specifications.

- [http://www.ncsa.uiuc.edu/General/Internet/WWW/HTMLPrimer.html](http://www.ncsa.uiuc.edu/General/Internet/WWW/HTMLPrimer.html)  
  HTML Primer

- [http://www.kosone.com/people/nelson/nl.htm](http://www.kosone.com/people/nelson/nl.htm)  
  Web designer style guide

  Microsoft's Tag library. This is a quick-reference for all HTML 2.0 tags and all Microsoft Explorer extensions. A nice reference.

- [http://www.w3.org/hypertext/WWW/Provider/Style/Overview.html](http://www.w3.org/hypertext/WWW/Provider/Style/Overview.html)  
  Tim Berners-Lee's style guide -- recommended.

- [http://www.taoh.com](http://www.taoh.com)  
  HTML resource, will be on-line soon.

**Hyperfiction**

- [http://www.users.interport.net/~rick/lies/lies.html](http://www.users.interport.net/~rick/lies/lies.html)  
  "I hate scroll bars, because they are intrusive to my reading experience," says Richard L. Pryll Jr., author of Lies!, a HyperFiction work.

- [http://www.feedmag.com/95.09guyer/95.09guyer_sample1.html](http://www.feedmag.com/95.09guyer/95.09guyer_sample1.html)  
  Hyperfiction links and commentary

  A Hyperfiction work

40
- http://garnet.berkeley.edu/~net-co/fiction.html
  More hyperfiction

- http://www.aaln.org/~kmm/
  A page full of hypertext and hyperfiction theory and resources.

- http://www.duke.edu/~mshumate/hyperfci.html
  This may not last, but it is chock full of hyperfiction stuff

- http://www.feedmag.com/95.09guyer/95.09guyer_sample1.html
  Hyperfiction reading list

---

Miscellaneous

- http://www.unitedmedia.com/comics/dilbert/
  The Dilbert Zone

- http://www.css.itd.umich.edu/users/djf/shakespeare/index.html
  The complete works of Shakespeare on-line.

- http://uts.cc.utexas.edu/~churchh/janewrit.html
  The complete works of Jane Austen.

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Please use the comment form to communicate any questions or suggestions.

Contents | Introduction | Methodology | Survey | Results | Summary | References | Links | Thoughts
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Last Updated: 10 May 1996
Thoughts on Web Publishing

- Barriers to Electronic Publishing
  - Physical Discomfort
  - Cultural Discomfort
  - Commitment to Perpetuity

- Hypertext Publishing
  - Hypertext as a Navigational Model
  - A Brief History of Hypertext
  - Hypertext vs. Linear Presentation
    - Associative Indexing
    - Navigation Paths
  - Brief Notes on Technology
  - Recipes for Creating Hypertext

Barriers to Digital Publication

The World Wide Web explodes into being in 1994. By 1996 every academic publication and college and university is at least thinking about publishing information on the Web. But the transfer of credibility from a print medium to a displayed medium for the publication of information will take a bit longer. There are significant barriers to people's acceptance of the Web as a robust, reliable and credible repository of information, the driver behind our advancement as a culture. This section, which is largely a result of original observation, highlights some of the barriers to the acceptance of digitally published information.

Physical Discomfort

Let's face it. A book is a whole lot more fun to read than a computer. Computers, even the best of them, can't be tossed carelessly into a pack. A computer isn't very cuddly in bed. Computers are still really loud, almost as loud as refrigerators. Batteries are woefully inadequate to the task of powering a computer for the duration of even one domestic air hop, let alone a week in the wilderness. For convenience, comfort, readability, and reliability, books have it all over present-day computers.

The small size, poor resolution, and fragility of a computer screen makes it a pathetically poor substitute for a newspaper with its square feet of surface area and infinite foldability, or a magazine with its glossy paper and instantly available graphics, or a book with its
robust spine, readable print, and longevity.

"But the technology will improve," the visionaries say [Negroponte, 1995], and I'm sure they're right. But it will be some time before the computer, in whatever form it may assume, will match the breadth and depth of reading pleasure that today's print formats already provide.

Am I a Luddite? [http://vista.hevanet.com/bilbao/luddite.htm] Absolutely not! Digital information may cause some physical discomfort for readers (in 1996 and probably for some time in the future), but the advantages of accessibility, availability, connectedness, and malleability make digital information here to stay. (And for seeing-impaired readers, digital representation in a large font or "read" by a computer can be a godsend.)

Even in April, 1996, I've downloaded George Gilder's hypertext essays [Gilder, 1996] to loaf through later at my leisure (in an airport lounge in one case). I could certainly buy his book (and will when it is finally published), but the information is available now and costs only the respect that copyrighted information deserves. The wealth of information available on the Web will only increase over time. Getting today's Wall Street Journal and the complete works of Shakespeare without leaving the comfort of my easy chair or even taking off my bedroom slippers is pretty tough to beat. Not to mention checking movie schedules, getting current world oil production statistics, reading a local restaurant review, buying airplane tickets, and finding the ferry schedule to the Aran Islands, all of which I've done on the Web in the past month.

Cultural Discomfort

The cultural discomfort with digital publishing varies widely among individuals. Many who will read this thesis will not find its publication on the Web culturally uncomfortable (and what do I mean by that, anyway?). But ask your great aunt who refuses to use an automatic bank-teller machine how comfortable she would be reading her favorite Jane Austen [http://uts.cc.utexas.edu/~churchh/janewrit.html] on the Web. Chances are she'll recoil in horror if she even understands your question. This is not a reflection on your great aunt, rather a comment on how difficult it is for people to learn and accept new thought models.

Cultural discomfort is found at the fracture points in human history. Large facture points like communism or the industrial revolution and smaller ones like touchtone phones cause discomfort in people. Any change causes discomfort. The larger the change, the larger the discomfort. My children may find reading books on the computer more natural than going into that dusty old library, but even I at the bleeding edge of technology still much prefer curling up with a good book on a rainy afternoon than logging onto the Web and surfing my way through Julius Caesar. [http://www.css.itd.umich.edu/users/djf/shakespeare/index.html]
There is a more significant cultural discomfort that merits deep respect. Digital Information is susceptible to alteration. In Spring, 1996, the Web is a frighteningly unreliable medium. Virtually all webpages are "under construction" (as this one was until published), subject to change. Links to other pages are often broken, sending the surfer into 404-land (an error message saying that the requested page is not found).

But society will accept a new mental model if the benefits outweigh the costs. The Web is clearly such an advancement. We will find ways to feel good about the Web as a repository of our vital information. We will overcome our cultural discomfort with the Web.

---

Commitment to Perpetuity

The cost of maintaining information in libraries forever is deeply engrained in our culture. We revere libraries as protectors of information and fund them accordingly. The Library of Congress [http://www.loc.gov] and our university libraries are cherished for the role they play in preserving our culture. We will not overcome our innate fear of information published on the Web until we commit to maintaining adjudicated digitally-represented information in perpetuity.

In attempting to make this thesis metaphysically complete, I tried to convince MIT to accept my thesis published on and only on the Web. There is something philosophically satisfying about publishing a thesis only on the World Wide Web and not printing it on paper and binding it for submission to the thesis committee and subsequently to the library. And the value of having this information available at the click of a mouse is immense. Libraries can be hard to get to... I met with sympathetic, but consistent resistance. The general message was, "this makes sense and will probably happen someday, but not today, not on my watch."

I understand this feeling and attribute it largely to cultural discomfort rather than physical discomfort or maintenance-in-perpetuity costs. It falls to some future person (perhaps as soon as next year) to break the cultural barrier that prevents academic works from gaining credibility on the Web. It is, of course, a paradox. The Web won't be credible until our respected institutions support the information published on it; and our respected institutions won't support the Web until it becomes more credible. With all due respect to this academic institution, the change will come very quickly, and the current resistance will feel kind of silly.

---

Hypertext Publishing
Hypertext publishing, though wildly popular on the Web and for on-line help systems, is in its infancy. The concept has been around for 50 years (more on this in the History section) and was proven with the success of Hypercard (which shipped on every Macintosh computer after 1987) and on-line help systems. A few visionaries have written hypertext fiction (see the Links section). But there is no reputable "Elements of Hypertext Style" or established curriculm to teach people how to read, let alone write in hypertext. Some of the more interesting facts and features of hypertext publishing are found in this section.

Hypertext as a Navigational Model

Hypertext or hypermedia is the navigation model underlying the World Wide Web. Its presence is so influential as to define the culture of the Web. Much as interstate highways as the navigational model of personal transport has defined our society (the merging of sister cities, the growth of suburbia, the formation of Edge Cities), hypertext as the navigational model has defined the cybersurfing, accessible-information culture of the Web. We, even in April, 1996, take this navigational model for granted, as we take air, food, and water for granted. But hypertext didn't always exist.

Hypertext is not an obvious outcome of the brains of creatures who live linearly from birth to death, and whose communication patterns have necessarily paralleled this linearity. Stories traditionally have a beginning, middle, and end. Authors rarely begin a story at the end, and when they do, it is a literary device to make the reader's understanding of the story more complete. Complex ideas are communicated linearly, one step at a time. Most people need this direct, step-like presentation in order to fully understand the idea. Experienced readers will jump ahead, skipping over intermediate steps to get to the conclusion, but they do this at the risk of misinterpreting the message.

Hypertext, which is much like using a giant index into a world of thoughts and ideas, has brought a completely different way of communicating ideas. Ideas can be revealed as an onion reveals its core, one layer at a time. Or they can be hidden down obscure paths, rewarding the reader who searches diligently. Or they can be scattered about a document as pieces of a puzzle. This thesis, far from being revolutionary or innovative in its presentation of information, uses the Hypertext navigation model only to make it easier for casual readers to find and absorb the sections that interest them.

A Brief History of Hypertext

Most of the information that follows is paraphrased from the work of two eminent authors, Ben Shneiderman [Shneiderman, 1989] and Jakob Nielsen [Nielsen, 1990]. Both of these works were published before the Web explosion.
The table gives a very brief history of hypertext (adapted from [Nielsen, 1990], page 29)

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1945</td>
<td>Vannevar Bush proposes Memex</td>
</tr>
<tr>
<td>1965</td>
<td>Ted Nelson coins the word &quot;hypertext&quot;</td>
</tr>
<tr>
<td>1967</td>
<td>The Hypertext Editing System and FRESS, Brown University, Andy van Dam et. al.</td>
</tr>
<tr>
<td>1978</td>
<td>Aspen Movie Map, first hypermedia videodisk Andy Lippman, MIT Architecture Machine Group</td>
</tr>
<tr>
<td>1986</td>
<td>OWL introduces Guide, first widely available hypertext</td>
</tr>
<tr>
<td>1987</td>
<td>Apple introduces Hypercard, Bill Atkinson</td>
</tr>
<tr>
<td>1989</td>
<td>Tim Berners-Lee creates HTML and the World Wide Web</td>
</tr>
</tbody>
</table>

**Vannevar Bush**, Professor at MIT and National Security Advisor to Franklin Roosevelt during World War II, published in 1945 in the *Atlantic Monthly* an article called "As We May Think" [http://www.theAtlantic.com/atlantic/atlweb/flashbks/computer/bushf.htm] about an idea for organizing microfilmed information that

"affords an immediate step, however, to associative indexing, the basic idea of which is a provision whereby any item may be caused at will to select immediately and automatically another. This is the essential ingredient of the memex."

His main purpose was to help organize the explosion of scientific information. (It is interesting to notice that Tim Berners-Lee at CERN had exactly the same problem and proposed the same solution.)

**Ted Nelson** coined the word "Hypertext" in 1965 during pioneering development of his Project Xanadu, Inc. [http://www.datamation.com/FlugIn/LiveWire/bestof/xanadu.html] system, which has only recently been realized with the acceptance of the Web. Nelson's original Xanadu vision was to be a repository for everything that anybody has ever written. Sounds like Tim has drunk from this well, too... Nelson's ambition exceeds the Web's implementation, however, as his goal is to allow hyperlink access to every published byte of information (whereas today's Web allows random access to all documents, but only to author-specified anchor points).

**Andries van Dam** worked at Brown University in the 1960s on a Hypertext Editing System implemented on an IBM/360. When the research project was complete and functioning, IBM sold it in 1968 to the Houston Manned Spacecraft Center where it was used to produce Apollo documentation.

Architecture Group (since incorporated into the Media Laboratory) extended the hypertext concept in 1978 to Hypermedia by creating a user-interactive movie of Aspen, Colorado, where the viewer could direct the flow of scenes through the streets and buildings of Aspen.

Hypertext grew quickly in the 1980s as the personal computer invaded the desktop. The first commercial hypertext product was introduced by Office Workstations Limited (OWL) [http://www.almac.co.uk/business_park/ssf/2-60.html] in 1986 for the Macintosh.

Hypertext really took off in 1987, however, when Apple included Hypercard (developed by Bill Atkinson [http://redwood.northcoast.com/~savetz/ku/ku/quick_genius_behind_hypercard_bill_atkinson_the_novem on every Macintosh computer. Applications (including on-line help) using Hypercard quickly became ubiquitous.

And of course everybody is aware of the revolution that Tim Berners-Lee [http://www.w3.org/pub/WWW/People/Berners-Lee/] wrought in 1989 when he incorporated hypertext (in the form of HTML, HyperText Markup Language) into a new protocol for managing documents on the Internet.

Hypertext vs. Linear Presentation

Hypertext presentation has the potential (largely unrealized in this thesis and most existing Web documents) for dramatically changing the way in which information is presented. Both the way in which information is revealed and also how documents can be navigated bring about these possibilities.

- Revealing information in an "associative indexed" fashion (really nothing more than giving the reader an embedded index in every document and asking them for their preference) presents special challenges to an author who wishes the reader to have certain background before reaching a particular paragraph. On the positive side, readers are given the freedom to explore those topics of most interest without wading through masses of information.

- Allowing different navigation paths allows the possibility of altering the information that a specific reader reaches (thus allowing the story line to change based on a reader's choices). Not only can readers choose their own directions, authors can change the landscape. See the Hyperfiction Links.

Associative Indexing is the most dominant pattern for presenting information on today's Web. Readers are given jump access to information in both the author's material and often other authors' material (as in the Links section of this document). It is this behavior that
allows "surfing," "following a trail," and "targeted reading" that is so seductive (and often tiresome). Used properly (by both reader and author), associative indexing allows informed readers to quickly find information that is relevant; used improperly (again, by both reader or author), associative indexing results in chaos, confusion, and wasted hours (leading many companies to restrict the Internet access of their employees).

Using different Navigation Paths allows authors (see the HyperFiction Links section for examples) to write fiction that uses hypertext to give the reader control over the story's path and hence story line. (Though the story lines are predetermined.) One of the problems yet to be surmounted in the Spring of 1996 is that readers are not in general familiar with hypertext story telling. Both authors and readers have much to learn.

The danger of hypertext stems from two characteristics:

1. Readers have control over the flow of information, which allows them to take sound bites (or soundings, choose your own metaphor) of the information, with that action's associated shallowness.

2. Readers can "bookmark" (a new verb invented by the users of Netscape Navigator) the information of interest, which leads to a cavalier "I know where the information is, I don't need to actually know the information" attitude.

How dangerous these characteristics might be is left for each reader to decide.

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Brief Notes on Technology

Browsers Vary

Although a de facto browser standard has emerged (Netscape Navigator [http://home.netscape.com]), Microsoft is in hot pursuit with Microsoft Explorer [http://www.microsoft.com] and dozens of other browsers are available. Browsers still vary in how they present "standard" HTML commands (not to mention browser-specific HTML extensions). The W3C imposes some control over HTML, and the major browser builders of the day are not ignoring each other's innovations, but differences remain. (Though I would expect these differences to eventually disappear as Web technology enters the "specific" phase [Utterback, 1994, pp. 92-95].)

Display Devices Vary

Display devices render information in very different ways. HTML is definitely not a page-rendering language (as Postscript™ is). Though products to circumvent this problem (in particular, Adobe Acrobat™ [http://www.adobe.com/Acrobat] are gaining popularity as "helper applications," HTML does not give control over the font, spacing, color, resolution, or even size of the displayed page.
Hypertext Is Evolving

HTML is in version 3.0, but many users are running browsers that still use version 2.0. As long as the language is in flux, it will be dangerous to use features that are not available to the majority. An example of this today is Frames. Frames are nice, but many browsers cannot use them.

Internet "Pipes" are Still "Skinny"

The wires connecting a user's computer to the Internet are still of low bandwidth (often effectively less than 1000 bits/second). Dialup networks run over slow analog modems and corporate Ethernet networks are often overburdened. To complicate matters, the Internet backbones themselves are swamped with packets. All of these problems will diminish as the backbone improves, corporate networks speed up, and ISDN and cable-modem access improves. Still, images, moving pictures, and sound are not well-liked by folks with a skinny pipe.

Recipes for Hypertext Publishing

There are two basic approaches to building documents that take advantage of hypertext capabilities. The first is to write a normal linear document and then chop it into small pieces, each of which is complete and intended to be read linearly. After chopping into pieces, re-assemble the pieces using hyperlinks. The second approach is to define a framework that is the hypertext structure. This is similar to writing an outline, but is made more difficult by the n-dimensional nature of the structure. Any piece of text might link to n other pieces.

Write, Chop up, and Reassemble the Document

The write/chop-up/reassemble approach is in some ways the easiest as it makes use of people's existing ability (such as it is) to read and write linear text. It has the additional advantage of letting the author "see" the entire document before deciding how to divide it for easier access.

1. Once the document is written, it is printed out and cut into pieces of paper, one idea on each piece.
2. Tape the pieces onto a giant whiteboard to organize them and draw lines between the pieces indicating the hyperlinks and anchors. This presentation allows the structure to be created and altered without changing the actual document. It has the added quality of its hypertext structure being visually obvious.
3. Alter the document by adding links and anchors and breaking the text files into discrete files as necessary.
Notes: Some authors feel all "chunks" of information should fit in a typically-sized window (say 60 characters by 15 lines). This is a very small piece of real estate to present a thought of any complexity. But scrolling is not a particularly friendly way to navigate a lengthy document as your are forced to do with this thesis.

Blueprint, Build, and Grow the Document

Sketching the blueprint, then building the pieces, is a more natural approach to creating a living document. Starting with a blueprint (often no more than a napkin scribble), build the document one piece at a time and let it grow to fill the space. Documents rarely reach the same form as originally envisioned by the author. Rather than fighting this tendency of documents to grow in surprising ways, use it to allow more creativity into the process.

1. Write a blueprint for the document. This is conceptually the same as an outline of a traditional document, but is different in that the link structure might be quite complicated. I represent these links by lines on the page and by lists of related topics. But they are more naturally represented in the document itself.
2. Begin to write the document, maintaining links and exploring related topics as you write. Existing text and images can be quickly incorporated into this document.
3. Let the document grow. The new suite of HTML authoring tools allow to you add links and follow them without leaving the document (though this one was written with a text editor and a browser running in a separate window). This dynamic process is a natural fit to the way in which the Web is "read."

Notes: This dynamic, almost interactive, approach to recording thoughts is how this document was written, and I strongly recommend it.

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