The Impact of the Web on the Software Industry

FINAL REPORT

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Executive Summary

The report examines the Web and the requirements and opportunities it presents to the software industry. It includes some statistical data about the size and growth of the Web which has been collected from a variety of sources. It also analyzes recently delivered software products to identify the present trends which govern the software industry.

The report is structured to address the changes that have been brought about by the Web. These changes are grouped into

1. New products, which are either developments of existing products or else totally new.
2. Ways in which software is now being implemented to meet the requirements and opportunities of the Web.
3. New and augmented approaches to marketing using the Web
4. Changes and opportunities in product and service delivery.

Recent data suggests that in Canada there were 1.1 million Web users, compared to 14.1 million in the US. This community is growing at around 50% per annum. Of these about 45% are business users. The total expenditures over the Web are hard to determine but totaled around $1 billion in 1996: this is expected to grow rapidly.

The largest single area of opportunity for software businesses is in the provision of intranets to corporations.

Amongst the trends noted were:-

1. The Web will become a single interface for a multiplicity of services.

2. The Web is achieving its results through collaboration as much as through competition.

3. The Web is building a set of services based on common technologies. The need is to balance this technology push with real values provided to users who can pay. Intranets appear to be the most significant market.

4. The Web has become the key driver for IT developments. If IT developments do not relate to the Web, their success will be limited.

5. Web users need help to be able to employ the Web effectively. At present many users stick to the sites they know.

6. The Web is a growing vehicle for making purchases. Security issues are the major inhibitor.

7. The era of the free Web is ending and a variety of revenue generating methods are being tried.

In the category of new and enhanced products for the Web it was noted that 21% exploited the data access properties of the Web and 46% addressed the ways of working and doing business. The underlying trends for this included:-

- Integration through the Web is blurring organizational boundaries. Partnerships on the Web are doing the same thing.

- Many single user products are being developed for organizational use: this shows the inadequacies of the basis of the tool design and a deficiency of integrative capabilities. No clear targets exist for replacements of paper documents as an end-product.

- A trend is to make easy to use versions of products as soon as stable definition of function and operation has been reached.

There are also some issues:-

- If the Web is regarded as a large data-store, then without control over the data source there are issues about replicability of a process, unless the data is copied, in appropriate context, to the local site. This results in data management requirements for the imported, multi-structured materials. This type of requirement does not seem to have been addressed.

- Implicit in the redevelopment of software is a sense that there are better ways of working than existing software allows. These new ways of working are not based on a sound understanding.

- It has become apparent that some Web paradigms are already disappearing. This is not because of utility changes but because of environment changes. Lifetimes on the Web are very short.

In the system software area the changes also result from some key trends, notably that the complexity of system software is rising, developments require platform independence and high productivity tools, and that price and performance are key issues. In addition the industry structure is gradually consolidating as software tool integration occurs.

The changes in marketing are dominated by the high degree of customization that is possible for all products and marketing approaches which demands detailed data which is not necessarily available, by the integration of marketing and sales to form streamlined organizations, and by the search for direct and indirect revenue streams, e.g. third party advertising, demographic data sale, knowledge sale.

In product delivery the trends are to provide as much software delivery and support over the Web as possible: this includes first delivery and also updates and fixes. Support services which have been outsourced by large organizations are becoming more economical as Web delivered services. The transaction security and reliability issue is being addressed in part by reputable third parties. This combines with other changes to create some fundamental business restructuring which is based on narrow specializations. The other changes include the redefinition of existing businesses in information terms and not product terms.

Overall business has to address a more fluid environment which is characterized by increased rates of takeover and mergers between businesses, with enhanced requirements for responsiveness and uncertainty with respect to regulation which is appropriate for Web business.

A Web based software business needs to share in a vision of what the Web is and what its potential is: all developments have to be undertaken in awareness of what is happening elsewhere. Agility and partnership are two other key factors for success. All of the categories of software development examined in this study offer opportunities, but there remain a number of challenges, which include making products easy to use, particularly for the less expert users who are the source of the new growth compared to the early adopters, the need to incorporate real functional expertise into the software product, and the need to address diverse requirements in a single product.

A sample of Web pages for small and medium Canadian software companies showed that only limited use was being made of the Web for marketing and sales: only 30% of companies offered downloads of software.

The factors that strategies for software companies have to address include:-

- ways of making revenue opportunities in what has been considered a free system
- takeover pressure from the provider of the platform on which the product is built
- how to create results rapidly
- what are the standards that need to be used and where are they being set

The strengths an organization needs are speed, focused expertise, vision and the ability to be attractive to potential partners.

Twelve overall trends have been noted: these are:-

1. The Web is a powerful engine for integration. It brings together many services and also allows different organizations to work together. As products, particularly software development products, integrate, so the market will become dominated by a few larger players.

2. The Web is being built on available technologies. The need is for applications of this technology which provide value to markets which can pay. Intranets as adjuncts to the Web, and as employers of the same technology are a dominant market.

3. At present the Web is IT. The leading area of innovation is doing new things not in improving existing ones.

4. Growth of the Web depends on ease of use. Easy to use versions of established functions and operations follow quickly on acceptance.

5. If security were seen to be better, the Web would see more revenue related growth.

6. Revenues have become important on the Web. As soon as payments are required, delivered value becomes an issue, which leads to how the quality of information provided can be warranted. Diversity of revenue streams through advertising, the selling of associated data, or the sale of knowledge associated with products and services, are all blurring the sense of who is actually making money on the Web.

7. Much development has been piecemeal, limited applications to meet limited goals. Some critical areas of how work is done on the Web, in terms of both product and process, are not supported by a good enough understanding. A key issue is what will replace the document as the central item in the Web world. Without this requisite understanding it is hard to ensure that products provide value, and impossible to achieve any level of optimization.

8. The Web offers great potential for individual customization but the data about the individual is site-visit related and not individual focused.

9. For the Web to be a legitimate growth point there is the need for better performance. Performance is being addressed through basic facility investment, through a variety of strategies for reducing traffic, and through improvements to protocols.

10. The cost of Web access is a priority growth point, low cost alternatives for the PC are helping to drive down PC costs: the operational costs are being addressed through a range of intelligent software systems. These are resulting in what have been outsourced services being mechanized over the Web.

11. Software value on the Web depends on availability anywhere, hence the use of platform independence, low cost which drives high productivity software tools and methods, and a narrow specialization which demands collaborations and standards.

12. Information is becoming a real asset i.e. from which revenue can be directly generated, and this evolves through business redefinition in information terms. The values provided are either access to resources e.g. name registration on the Web, or through leveraging expenditures to get better value for money.

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1 Introduction

The report addresses the impact on the Canadian Software industry, both actual and potential, from the Web. The size and scope of the Internet and the Web as a subset of the Internet are reviewed to present a general background and some balances suggested to verify the numbers that are forecast. The numbers show that the Web is a continuing phenomenon in which substantial investment is being made and for which a wide range of companies, both large and small have significant plans. The data also shows that the Web is the largest single market for certain kinds of product, including potentially software, and the Web itself acts as a single point of contact with that market.

The report is structured to address the changes that have been brought about by the Web. These changes are grouped into

1. New products, which are either developments of existing products or else totally new.
2. Ways in which software is now being implemented to meet the requirements and opportunities of the Web.
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All of the areas are potential software markets: the report surveys recently released products and shows where they fit into the overall development of the Web. In addition they provide examples of how businesses, including software businesses, are adapting to the Web. Each section concludes with a review of the trends and factors which appear to be common to the software development activity noted.

The seventh section identifies some of the changes in all businesses that have been brought about by the Web and which apply with particular strength to the software industry.

From the preceding material a view is presented of the characteristics which are apparently shared by the software industry, particularly, but not exclusively with respect to the Web based part of it. This section concludes with a view of the use being made of Web pages by small and medium sized Canadian software businesses.

The ninth section summarizes the strategies which apply in this field and the tenth section summarizes the twelve trends which dominate what is happening on the Web which affects the software sector. The last section is a glossary of some of the terms used in the report.

2 Web History and Forecasts

2.1 What the Web is and what users would like it to be

The Web in principle differs from the Web in practice. The ideal Web is universally accessible, allows instantaneous transfers, contains specific information which is easily locatable and makes all its features easily used. In practice we know that only some services, including Web access, are locally available at any point. The effective data rates, seen at the user's computer, are often only a few bits per second, and even these transmissions do not necessarily run to completion. The information accessible on the Web is often only found with difficulty, and to determine the quality of that information is harder still. Ease of use is still in its infancy and although there have been substantial improvements, there are still clashes between software products which cause failures. To make effective use of the Web still requires mastery of the advanced features of browsers and other tools. In addition there are deficiencies in the security of information and transactions on the Web; there is not a universal way of paying for services.

However, the Web is a very usable entity as is shown by the large numbers of users. The opportunity that exists for the software industry is to make a virtual Web, through their products, which corresponds more nearly to the ideal Web. This opportunity is inherently dynamic, for the real Web is changing and so are the expectations of users, service providers and business: there are increases in bandwidth becoming available; wireless access is becoming more viable. This means that software products are likely to have limited lifetimes, either because they become obsolete, or because they become absorbed into another more integrated product. To operate in this environment the software business needs to be agile.

In the main, the greater the opportunity the more vulnerable the provider will be. Microsoft, through an acquisition and internal development approach, seeks to maintain its leadership position and possesses such significant financial resources that few areas of opportunity are outside its interests. It seems that the definition of an area of opportunity is that Microsoft takes an interest in it. Even so, large numbers of entrepreneurs are prepared to seek a market on the Web, because they see it as the greatest opportunity at present.

Will the Web become the single interface to the world, reuniting all the disparate vehicles used for office and business functions? Will it unite the office and the place of business? Will it unite the consumer with the supplier? Fragmentation induced by recent technology has created communication problems in the business world. There are so many alternative channels available, phone, cell phone, pager, letter, email, voicemail, fax, that no one of these has become certain in establishing contact: one goal for the Web is to bring these separate functions together and to reestablish the certainty of communication. In the case of business, but also in other fields, a purpose for the Web is integration.

If that is the case, then the vehicle that meets this must be inclusive i.e. accepting all modes and not simply some modes, ubiquitous, synthesizing, aggregating and expandable. Such a set of qualities appears to offer an unrealistic goal: however, the Web has already shown itself to be a vehicle for powerful collaboration, and hence, may achieve these high targets.

2.2 History

A precursor to the structure of the Web, allowing links to be made between arbitrary nodes was developed at CERN in 1980 by Tim Berners-Lee. From this basis a proposal for a world-wide information network was developed intended to facilitate information sharing amongst the international physics community<1>.

This evolved so that by 1990 the name World Wide Web had been adopted and some work commenced on browser software. By mid-1991 there was a general release on CERN machines, and in the fall a gateway was installed, which made WWW accessible to the world by the end of 1991. In 1992 the facility spread through the physics community and in 1993 the spread extended to a wide range of users.

WWW was responsible for supporting:-

1. the transferability of information across the Internet in a far easier fashion than hitherto, making the potential user community a significant fraction of the world population.
2. the ability to use many different modes of information, not simply text.
3. the opportunity to develop significant types of transaction across the Internet e.g. paying for information, providing services.
4. the development of a market for new software and new applications
5. the creation of assets, such as names, for which administration and marketing became possible.
6. the creation of highly flexible tools, which in turn spawned intranets.

The early 1990's model for Internet growth<2> was based on the expectation of the emergence of a single dominant use. In the 1980's entertainment spending in the US had risen from $4.7 billion to $31 billion in ten years. It was expected that Internet might provide an entertainment service which would acquire a significant portion of these revenues and also of the expected continuing growth. By 1993 the expenditures had grown to $37.8 billion, which was divided between :-

basic cable	$13.5 billion(36%)
home video	$12.5 billion(33%)
pay cable	$5.5 billion(15%)
theatres	$5 billion(13%)
pay per view	$1 billion(3%)

The annualized growth rate is about 17%, some of which can be translated into a demand for Web based service. The pay per view category, the smallest and most recently added, is most nearly equivalent to what the Web offers.

This single use model ignored markets such as business ones, for which entertainment is not a consideration, and has been replaced. Now the expectation is that there will be multiple applications driving Internet growth, use and revenues, just as the phone network carries private, business, voice and data traffic. The probability is that this will be Web growth, not just Internet growth, since the Website now has many capabilities which support the requisite variety of applications to fuel the growth.

The current belief is that entertainment will be important and that the technologies which make entertainment viable over the Web will also support the other major applications. There is an obvious common requirement between movies, TV and video-conferencing: all need ways of transmitting large amounts of data, storing it and capturing it. Hence there is a phased model of growth. It starts with basic technology development aimed at some common need, and as that need is met and grows so there is more incentive to further develop technology for this need, which will generally lower costs, increase functionality and improve quality. At this point other applications become viable which can exploit the base of technology already developed, i.e. the common infrastructure.

For example, a fundamental technology required to access home and small business is improved local access to provide much greater bandwidths than are presently available at a reasonable cost. This requirement exists for any video based service. A further step would require parallel improvements in wireless access so that Web use becomes as location independent as cell phone use makes voice communication location independent. On top of this the capability of interacting with separate groups in parallel sessions in near real-time, will mirror most closely the multiactivity business environment. This same capability offers rich vehicles for education and for entertainment. All these developments are in reach.

The Internet is now perceived as the driving force for Information Technology(IT)<3>. It is the most rapidly changing part of the IT world and all other parts of IT are scrambling to keep up with it. The Web, those facilities on the Internet associated with URL(Uniform Resource Locator) addressing, is the cutting edge of Internet. It is the Web which is subject of this report.

2.3 What are the Web statistics of interest to the software industry?

In general the size of each Web population is of interest and its capacity to pay for what it requires. This information is not always directly available and has to be inferred in some cases. The physical characteristics of the Internet are of interest as they determine the size of the market for products such as server software.

Present business activities on the Web<4> include:-

communication (internal and external)
information management and distribution
public relations
customer service

technical assistance
cost containment
marketing and sales

Software which addresses any of these areas will find an opportunity on the Web.

2.3.1 Function vs. Content

The software industry can provide applications which do things i.e. provide a function which in itself is valuable to the user, or which is valuable in the context of the Web. An example of the former case is finding information: of the latter, a Web browser. In the long run the former represents real value to the user and the latter is only a means to an end. Both are viable commercial possibilities.

The industry can also provide content i.e. databases, now in multimedia form, which may be accessed randomly or sequentially and may provide video and sound.

Accordingly the parameters of interest are:-

the number of personal users of the Web and expected expenditures
the number of business users and expected expenditures
the number of content suppliers and expected revenues

2.3.2 Direct sales vs. Service providers

The individual users, those who get direct value from the Web, whether it be entertainment, information or function, represent one market, the numerically largest market. The service providers are those who operate Web-sites which will be used in one way or another to generate revenue. This market has the advantage of being smaller than the former i.e. it is more focused to access, and it is more prepared to spend money as part of its own business venture. The service providers may be service providers directly to consumers, or to other service providers, offering business services such as secure transactions, advertising, etc.

In addition to the previous parameters are:-

the number of consumer service providers and expected revenues
the number of business service providers and expected revenues

2.3.3 Facility Infrastructure vs. Private Infrastructure

Both infrastructures are a mix of hardware and software. The boundary between the two is ill-defined, but facility infrastructure can reasonably be considered as the backbone communication facilities, the routers and those servers which are directly accessible by the public. The private infrastructure is what is known as intranets. The markets here are for the various levels of software which are more or less integrated with the hardware. The lowest levels tend to be dominated by in-house capabilities of the telecommunication product suppliers, but at any level where general purpose computers appear, there is usually a competitive market for software.

The third group of parameters of interest are:-

- the number of servers, with interest in both provision of basic software and for added functionality, hence the former is more interested in growth whilst the latter in total number
- the number of Web-sites, with the same proviso
- the number of intranets

2.3.4 Other parameters of interest

The expected investment in the facility infrastructure is interesting because it suggests how the continuing growth of all the markets will be sustained. Likewise if greater bandwidth is likely to become generally available without disproportionate cost increases, then the interest in bandwidth economizing capabilities will have a limited duration.

2.4 Web Data

2.4.1 Total Web Users

In all areas conflicting, or apparently conflicting estimates have been produced. The conflicts arise from several sources:-

- the rapid growth means that data collected only a few months apart can show large differences
- the definitions used have varied widely and there is no standard set of definitions as yet
- the methodologies of collection have also varied, and have in some cases been flawed, or the use that is made of them is inconsistent with the data collected e.g. samples do not conform to the general demographics of the whole population and hence extrapolation is suspect
- the known association of parameters are not catered for e.g. the higher use of the Web by males than by females

A systematic reevaluation of the 1995 Commerce Net/Nielsen survey has been carried out<5>, which allows a more exact base view to be obtained of usage, but as a single survey offers nothing about growth rates. The reevaluation has been done to make the data more exact for the US, whereas the data was collected in Canada and the US. It has been possible to make some calculations to obtain an approximate Canadian view, which is presented below<6>.

Four categories of use have been defined:-

1) those with access to the Internet
2) those who have accessed the Internet from home, work or school in the past three months
3) those who accessed the Web in the past three months (Web users)
4) those who have purchased a product or service through the Web

The numbers in each of these categories, were separated for the US and Canada, and demographically corrected, for the US. A further correction can be applied to eliminate those answers which fail consistency checks. The Canadian numbers have been estimated using weights derived for the US and hence can be considered only approximate. In percentage terms Canada appears to be trailing the US in adoption rates. In the table below each category is a subset of the category on its left.

Basis	Internet access	Internet users	Web users	Purchasers
Canada and US data combined	36.8 million	24.0	18.2	2.5
Demographically corrected US data	28.8	18.4	14.1	1.58
Canadian estimate	3.1	1.7	1.1	0.42
Canadian consistency checked	3.1	1.5	1.1	0.41
US % of population	11.1%	7.1%	5.5%	0.6%
Canada % of population	11.5%	5.6%	4.1%	1.5%

In 1996 14.7 million US households were identified as owning a PC and using the Internet<7>. In 1996 20% of homes with a PC had 2 PC's: this will rise to 33% in 2,000<8>. This is a reflection again of the income level of users: however descending prices of computer equipment will help to encourage Internet use amongst lower income groups.

A.C. Nielsen of Canada reports 50% of Canadian households have PC’s. Phase 5 Consulting group reports 21% of the workforce use digital information, but the workplace is well ahead of the home in terms of PC penetration. The 21% is expected to rise to 35% by the end of 1998<9>. This shows that the basis for Web use exists in both households and business, but it is not yet being used for that purpose. There may be little new investment required in hardware, which suggests that limitations may be in perceived value of Web access, concerns about ability to use the Web, or the availability of appropriate software. Existing software has allowed a large number of users to access the Web but a single common platform may be unresponsive to individual differences. Existing software, for example, may seem good to young males, the currently dominant user category, but not to females nor to older males.

Other breakdowns of users are available, but a key one for market purposes is that the average income of Internet users is $59,000(US) compared to the US 1994 average income of $20,690. It may be concluded that users have high disposable income.

Unevenness of access is shown by the data that 30% of users are in education, and 28% in computer related work: professionals are 19% and management 11% of users. These categories account for 88% of users.

2.4.2 Growth of users

Based on total population it may be seen that growth by nearly a factor of 10 in Web users is a real possibility. However, the correlation between education level and use of the Web is marked: the origin of the correlation may be based on consequent socioeconomic category and hence the available income. The correlation of use with income is also pronounced, but both observations may stem from a common source. These correlations are the basis for adopting a more conservative limit to growth of, perhaps, a 5 times multiple.

At present there are twice as many Web users as those who use Internet alone. Hence a reasonable expectation is that there could be a relatively rapid increase in number of Web users by 50%<10>. There is also as a big a group of non-Internet users who yet use computers for fundamentally similar tasks, presumably at school or at work. Given access to the facilities this group is likely to migrate gradually to the Web world, which is a slower migration but one which would double the size of the Web+ Internet only group.

Consensus numbers on Internet user population<11>, obtained from a review of 13 independent surveys, suggest that at year end 1995 there were about 19 million Internet users, of whom about 7.5 million actually owned the access facility (vs. shared access). The total number had increased to 30 million by October 1996 i.e. a growth rate of just over 50% in 9 months. (80% per annum). These growth rates are sustainable in the short term.

Households online<12>:-

Year	US and Canada	Year over year growth (%)	Worldwide	Year over year growth (%)
1995	9.6 million		15 million	
1996	15.4	60%	23.4	60%
1997	22.3	45%	34	45%
1998	28.7	30%	45.2	33%
1999	34.6	20%	56.7	25%
2000	38.2	10%	66.6	10%

Given that the US market is much closer to saturation than the rest of the world, the year over year growth numbers probably underestimate the worldwide growth rates. From a commercial point of view the non-US part of the Web usage is probably mainly educational and governmental, so that in reality the real markets of the Web are North American, at present.

It is predicted that by 2000 there will be as many Internet connections as phone connections. The connectivity level of the phone service, achieved over 100 years, will be achieved by the

Internet in 10 years<13>.

2.4.3 Requirements of Web users

In the present Web user group only 7% classify themselves as skilled users of Web Facilities: 13% find it difficult to do what they want. This percentage who have problems may increase as the less highly motivated mainstream adopters start using the Web. This suggests that there is a significant need for:-

- improved products
- instructional software, including embedded help functions
- help services

45% of users have made use of the Web for business purposes and 18%<14> have made a purchase based on information acquired through the Web: these purchases were not necessarily made via the Web. At present there is some indication that the Web is an information source which leads to purchases through conventional channels rather than consummating the purchase on-line. For example at Music sites 35 visitors look for information vs. 11 who buy: with movies and videos the proportion is higher, 42 look for information and only 5 buy. In the case of software 65 look for information for every 16 who buy<15>.

Existing user activities<16> may be classified as:-

77% browsing
64% entertainment
53% education
51% work related
41% business research
36% academic research
19% shopping

59% of users have some Web-sites which they visit repeatedly to see what is new at them, i.e. there is a site loyalty phenomenon.

2.4.4 Companies with Web Sites and their needs

76% of large companies now have Web sites<17>. In the next 12 months the following purchases, associated with Intranets, are intended:-

43% of companies want Web-site development software
38% want HTML software
37% want Internet servers
34% want Web browsing software
30% want file servers
27% want security products
22% want high speed modems
21% want search tools
13% want T1 lines

This suggests a demand for software products which is twice that of hardware. The Canadian position is similar to that of the US. A.T. Kearney Ltd. reported that 22% of Canadian firms have Web sites and 39% plan to have them<18>. It is noted that large firms are ahead of the small ones in this.

2.4.5 Intranets

A study by Forrester Research Inc. found that 16% of firms surveyed had an intranet in place and another 50% were actively engaged in implementing one or planning one. Very high rates of return on the intranet investment, with annualized rates greater than 1,000% have been reported<19>.

2.4.6 Number of hosts

Year start	Number of virtual hosts	Number of physical hosts	Number of Web servers
1993	1.3 million	0.4 million	
1994	2.2 million	0.6 million	
1995	4.9 million	1.0 million	
1996	9.5 million	1.7 million	60 thousand
1997	12.9 million	na	462 thousand

Server software was led by Apache(freeware for Unix) at 38%, NCSA at 16%, Netscape at 13%. Microsoft's IIS(Internet Information Server) accounts for 7% of sites, but this may be under-represented as the software is now included free in Windows NT4.0.<20>

Date	Number of Web sites	% .com sites	Virtual hosts per Web server
6/93	130	1.5	13,000
12/93	623	4.6	3,475
6/94	2,738	13.5	1,095
12/94	10,022	18.3	451
6/95	23,500	31.3	270
12/95	100,000	50.0	94
6/96	230,000 (est)<21>	na	41
12/96	1,000,000 (extrapolated)	na	15 (extrapolated)

The trend in this data suggests that 1 host per Web-server may be reached by mid-1998. This may be translated as the tendency for businesses to acquire their own servers if they wish to provide a host.

2.5 Communications

2.5.1 Backbone traffic

In mid 1993 half of the backbone traffic i.e. between distinct sites, was composed of file transfers, which is the most general of the protocols on the Internet: by mid 1995 this had dropped to 25% and Web traffic has risen from essentially zero in 1993 to 25%. The Web traffic increase shows that it had become the driver of Internet growth.

2.5.2 Speed of connection

The rate at which users receive data is subject to their local access speed but also to the least bandwidth on the connection between user and source site, and to the traffic intensity. Achieved access rates may be as low as 100 bits per second even with a 28.8 kbps modem. This has resulted in a variety of strategies to improve performance. These include high bandwidth infrastructure which tries to provide more direct routing and at higher speeds: for this a premium price is paid and such service is only available at limited localities. This may change as the cable companies complete their trials and start to provide a more regular service.

At the same time because the traffic resulting from Web sites has an increasing graphic, video and sound content, the number of bits transferred per user connect is increasing. This may be the reason why the number of virtual hosts per Web server is falling. Some browsers permit the user to switch off images to reduce the amount transferred. Other software allows the user to download images overnight and then view them locally: this is at a price of reduced interactivity.

Another factor is the expectation of service level. As users start to depend on the Web so they will become more demanding of service level, in terms of reliability and performance. This may in effect result in an increased bandwidth allocation per user both directly and indirectly through increased redundancy requirements.

This raises issues regarding how viable it is to conduct business over an unreliable connection. Part of the problem is that the service is seen as free: there have been significant reductions in demand when any service offered over the Web, excluding products and services, have been changed from free to charged e.g. the number of people accessing the Wall Street Journal dropped by a factor of 2 when a yearly charge of $49 was introduced. This is in comparison to a print subscription fee of $164 per year<22>.

2.5.3 Investment in Communications

Parts of the backbone are being upgraded e.g. MCI has invested $60 million to improve its backbone from 45Mbps to 155Mbps<23>. There are plans to upgrade this further to 622Mbps. To put this in context this is less than the bandwidth used for 20 uncompressed TV channels.

MCI and British Telecom plan to merge their services under a new holding company called Concert. Concert will have annual revenues of $42 billion, of which $1.5 billion is derived from multinationals. It will provide service to 43 million customers in 72 countries<24>. They anticipate significant revenue growth from international Internet services.

The adequacy of the existing phone service will be tested by the expected Internet growth. Bell Communications Research estimates that $1.5 billion per annum will need to be invested in the US phone networks to meet Internet traffic requirements.

2.6 Revenues generated

What is the role of the Web? The revenues which may be generated will depend on the functions provided. A recent article<25> questioned whether the role was as an information source or as a marketplace. These two roles are not mutually exclusive. The Web started as a way of contacting people whom the originator knew, or knew of i.e. directed contact. It became a means of contacting people whom the originator found out about on the Web. Sources of information put their information on the Web to save themselves from excessive correspondence. Now the information carries advertising or is itself advertising. The link to sales has been made and services for the distribution of physical goods are linked in. Hence the Web is multifaceted and there will be a multiplicity of revenue streams associated with it.

Categories of Web business<26>

1. Facility providers, hardware and software
2. Commodity providers for access to some or all Web services, i.e. communications:

this is a price driven market.
3. Value added service providers, which offer ease of access services, built-in help desk, preferred access to proprietary (or bundled) services.
4. Middleware service providers which support Web-publishing, security, financial services
5. Application providers e.g. business services, games
6. Content providers e.g. multimedia databases, entertainment

The Web rests on telecommunication service providers who sell high-speed and low-speed access to Internet Service Providers(ISP's). The ISP's, use high speed links between themselves and lower speed links to the Web user base. ISP's may also be telecommunication carriers. The ISP's provide Web-sites, content access, intranets which are publicly accessible, and offer value added services to the user base.

The telecommunication service providers obtain part of their revenues from selling high-speed bandwidth: the market is becoming more competitive, but does not depend on the Web. It may be assumed to provide a profitable business.

The ISP's, in the general sense defined above, obtain revenues from multiple sources. This revenue has to pay for their telecommunication costs, their computer and related hardware, and software. The sources include user fees, Website fees, sales revenues, including content sales, and some advertising.

The software industry provides products to the telecommunications industry, which is largely provided in-house by the hardware manufacturers, to the ISP's including the public and private intranets, and to the end users, both personal and business. Its revenues are both direct i.e. payment for software, and indirect e.g. through advertising carried.

Ultimately the source of all revenues is the Web user community. It has been suggested that the increasing numbers of Web users will not bring commensurate increases in buying capacity. If the issue is simply one of discretionary income then this will be true: however the current expenditures do not accurately reflect buying capacity, because Web users are not yet wholly confident of the security of transactions on the Web and only a limited number of items can be bought. Both of these limitations will be eased as time passes and hence greater revenue flows may be expected.

In addition, if the Web is a way of making markets more efficient in economic terms, then there will be real savings realizable for basic expenditures e.g. it may become easier to find the lowest price option for any purchase. In this case a significant sales revenue increase could result.

2.6.1 Internet technology supplier revenues

Estimates of sales of technology for the Internet vary widely. The sales are split between the end-users (potential market, hundreds of millions), service providers (potential market millions including all servers and all Websites), and backbone service(potential market of a few hundreds). 1995 estimates vary from $1.2 billion to $5.3 billion: 2,000 estimates vary from $13 billion to $41 billion. Some of this variation is due to definitions.

The breakdown of sales appears to be $300 million to ISP's in 1995 (growing to $5,000 million in 2,000), $500 million for hardware, including routers, modems and computers (growing to $2,500), $300 million for software including server software and applications, (growing to $4,000 million). All this combines to a net of $1.1 billion in 1995 growing to $11.5 billion in 2,000.

Enabling services, including domain name allocation, transaction support, etc. is $20 million (growing to $1,000 million), Expertise (integrators and consultants) accounts for $50 million (growing to $700 million), and Content, which covers entertainment, information and shopping) is $500 million (growing to $10,000 million)<27>.

Another survey (Montgomery Services<28>) suggests that Internet software alone, presumably for users and ISP's, will grow from $2 billion in 1995 to $13 billion in 2,000.

Netscape Communications Corp. reported revenue of $115 million for the 4th quarter of 1996. This was based on demand for corporate software products and also on consulting services ($19 million). Related to total annual market sizes from the data above this implies that Netscape have about $400 million of a $600 million software market, and $75 million of a $100 million consulting services market. This suggests that the estimates are low, perhaps because all revenue channels have not been identified and captured. Open Text software sales based on the last quarter of 1996 correspond to an annual rate of $21 million<29> i.e. about 5% of Netscape.

The software opportunities cover a wide range of possibilities: some of the possible categories are<30>:

Analysis	Audio	Censoring Software
Conferencing	Database Gateways	Digital Cameras
Electronic Commerce	Email Products	Fax Related Products
Firewalls	Gopher Servers	Groupware
HTML Authoring	Internet Access	Internet Telephones
Intranet	Java	List Servers
Low Vision	Multilingual	News Readers and Servers
Offline Browsing	Organizing Utilities	Paging and Messaging
Press Cutting	Publishing	Remote Access
Search and Retrieval	Security	SGML
Slip, ppp	Software Development	TCP/IP
Telnet, FTP	Video	VRML Products
Web Browsers	Web Servers	Wireless Products

The 1997 market estimates and annual growth rates for intranets alone<31>, are:-

Hardware	$2.4 billion	60% pa
Software	$2.2 billion	100%
Development/integration	$1.8 billion	200%
Training	$1.2 billion	400%
Maintenance/admin	$0.8 billion	100%

The software part can be broken down as:-

System	$630 million	50% pa
Authoring	$430 million	60%
Content management	$700 million	300%
Other	$400 million	160%

2.6.2 Service Provider revenues

AOL's revenues grew from September 1995 (end of 3rd quarter) $220 million to $360 a year later. In this period revenues not derived from subscriber fees grew from $5 million to $25 million. However new pricing from AT&T and Netcom providing flat rate service has forced AOL to adopt a similar structure which will negatively affect its revenues<32>.

If the number of private account holders (7.5 million) is assumed to pay at 50%<33> of the now ceiling rate of approximately $20US per month, then this generates revenues of $900 million pa. With churn<34> and free offers this number may diminish somewhat.

For a total Web-user base of 40 million, direct revenues could be around $5 billion per annum.

2.6.3 Advertising revenues

In the Internet World survey 1996 advertising revenues were estimated between $150 and $200 million. (The 3rd quarter 1996 estimate was $66 million.) US domestic advertising in total is $166 billion. Other estimates lie lower than this but the total is expected by all surveys to grow to around $2 billion by 2,000 AD.

2.6.4 Sales revenues

Two surveys have independently suggested that around 2.5 million people have used the Internet for a commercial transaction. This may be shopping, banking or obtaining travel information. The largest area of success has been in selling CD's with 350 sites distributing CD's and the top 5 selling more than 25,000 each day. However the over-50's users of the Web, who have relatively high disposable income, are more likely to buy software and books.

The estimates of total sales revenue generated in 1996 varies from $50 million to $518 million. Predictions for the year 2,000 range from $6 billion to $46 billion. According to Price Waterhouse<35> Internet commerce generated $183 million in 1996, and intranet commerce generated $679 million. Intranets appear to offer security advantages and hence will continue to grow faster. They are in addition usually tied in to the purchasing processes of the supplier and hence use separate credit checking, invoicing and payment procedures.

What is not clear at this stage is what role barter plays in Web transactions. Some of the free information provided is paid for by demographic data collection: some may be paid for by influence exertion: explicit barter may also exist. To some extent the Web could become an underground economy on an international scale.

2.6.5 Content Provider Revenues

The market for automated information delivery, using a variety of techniques, and as different from demand response, has been estimated by the Yankee Group as $10 million in 1996, but growing to $5.7 billion by 2,000<36>. One company, PointCast, has already gained 1.7 million subscribers for its service of customized information through screen savers.

<u>2.7 Analysis</u>

2.7.1 Key data

Based on the requirements identified earlier some consolidated statistics based on the foregoing, using conservative estimating techniques are:

Web users
Canada: 1.1 million, with 1 year growth at 30%. US: 14.1 million, 1 year growth at 50%

Direct revenues (at $120 pa each)
Canada: $130 million US: $1.7 billion

Expected expenditures
Canada: $35 million in 1996, growing to $45 million in 1997. ($100 per spender, 30% spenders)
US: $150 million in 1996, growing to $225 million in 1997. ($100 per spender, 10% spenders)

Web business users
Canada: 0.49 million, with 1 year growth to 0.64 US: 6.3 million, 1 year growth to 9.5 million

Business expenditures through the Web (based on intranet revenues)
Canada: $95 million in 1996, growing to $124 million in 1997
US: $585 million in 1996, growing to $878 million in 1997

Content revenues (Based on total revenues less consumer sales)
Canada and US: $750 million in 1996

Consumer product and service sales
Canada and US: $250 million in 1996, growing to $500 million in 1997.

Number of Web-servers (based on Website growth)
Worldwide: 462K in 1996, 4.6 million in 1997

Number of Websites
Worldwide: 1 million in 1996, 10 million in 1997

Number of intranets
Canada and US: 30% of medium and large business

Investment in infrastructure
Canada and US: $1.1 billion in 1996

2.7.2 Consolidated revenue flows

Telecommunications providers	Revenues: ?	1997 investment $1.5 billion
ISP's (excluding intranets, content value-added services)	Direct revenues $1.83 billion Indirect revenues: ?	1997 investment $3 billion
Intranets hardware		$2.4 billion
Software		$2.2 billion
Services		$3.8 billion
Total external intranet revenues	$679 million (1996)	
Internal returns	?	
Content revenues	$500 million (1995)	
Advertising revenues	$300 million	
Direct product and service sales	$183 million (1996)	
Totals	$3.49 billion	$12.1 billion

This shows an imbalance which may be covered by the missing revenues, or may be an investment against future expected revenues.

2.7.3 Key Trends

1. The Web will become a single interface for a multiplicity of services.

2. The Web is achieving its results through collaboration as much as through competition: it is only collaboration that can achieve the high level goals of the Web.

3. The Web is building a set of services based on common technologies. The need is to balance this technology push with real values provided to users who can pay. Intranets appear to be the most significant market.

4. The Web has become the key driver for IT developments. If IT developments do not relate to the Web, their success will be limited. The Web technology is moving to meet business needs through Intranet development.

5. Web users need help to be able to employ the Web effectively. At present many users stick to the sites they know.

6. The Web is a growing vehicle for making purchases. Security issues are the major inhibitor.

7. The era of the free Web is ending and a variety of revenue generating methods are being tried.

2.7.4 Summary

Regardless of measures used the Web is a very large and rapidly growing market. Whilst it grows it also evolves: originally all use of the Web was free, all the server software was free, and there were no commercial opportunities. Now there are more opportunities for business. Information is being sold on the Web and not always given away: some of the server software and other access is paid for. Advertising has become a source of revenue.

In this evolution it is not always clear what size of market remains once a charge is introduced. Some services have reported a significant reduction in access. In some cases values of services have not been clear, which hinders the development of a pricing structure: in others there remain alternative non-charged sources for fundamentally similar material.

3 Changes in Software Products and Requirements created by the Web

This section addresses the new applications which relate to the Web and the new vehicle, Intranets, which carries Web technology into private use. The key feature of intranets is that they allow different parts of an organization to collaborate on a peer basis. There are no longer systems which are owned by a single department which can hold a whole organization hostage. Each organizational unit has responsibility for providing certain information, and can do this in a largely asynchronous fashion, each using their own database, but allowing others to access this through Web tools. This produces a new market for server capabilities, which is being met by suppliers which have gained acceptance for their products in the rigorous testing environment of the Web.

In addition the intranet can unify corporate communications and reverse the fragmentation that has been arising from voicemail, email, hardmail, audio-conferencing, video-conferencing, etc. For example video networking products, audio products, computer conferences and email can all be handled via a common intranet. If a gateway exists to Internet then the reach becomes extra corporate in one step. The fewer the number of independent tools means less learning time and hence more productive time. It also means less lead time before a person becomes productive.

What drives the software requirement? The first factor is change, in both the sense of alteration and augmentation. The changes in the environment create changes in all organizations which need to be matched by changes in tools. In what follows change is focused first on existing tools which need to be enhanced to use the Web environment, then on new opportunities created by the capabilities of the Web, then the specific category of security which has been cited as a major inhibitor of Web use, and finally ease of use products, which emerge once a given function and operation has been defined and accepted, to make a capability accessible to the widest possible market.

3.1 Products which are extensions of existing ones

3.1.1 Websheet

The power of the computer is enhanced by the network that it is connected to, provided the resources of that network are known and are reliable. The Websheet<37> is an extension of the functionality of the spreadsheet. It allows data from the Web to be connected to the spreadsheet, whether the Web is the Internet or an intranet. The AnyWare WebSheet, from Applix, embeds live data from the network into spreadsheet cells: this reduces time in inputting numbers and allows data to be maintained as current. The application is written in Java and, for example, allows a stockbroker to maintain a current view of investment strategy by allowing a spreadsheet to use the current version of market prices.

3.1.2 Format conversion

Products were originally developed to allow disks from different systems to be read at a single site: this has developed to allow files in proprietary format for one application to be converted to the format of another, e.g. Word to Word Perfect, email interchange between different systems and newest versions provide conversion capabilities to allow a variety of compressed formats to be decoded when sent as attachments or through ftp. See KEYview Pro 5.1 (www.ftp.com)

3.1.3 Data mining and analysis

Tools are being designed to automate the searching process either over intranets or the Internet to ensure that all relevant data is accessed. It is not tied to data which is stored in a particular database or format<38>.

3.1.4 Office tools

Oracle has produced applets to provide word processing, spreadsheet and presentation graphics functionality. The goal is to produce small programs which do not tie up machine resources with unwanted functionality, and which are easy to learn and use. The key is thatsuch applets can be easily shared over a network, use a common engine to drive them and hence gain some measure of platform independence. This may not be of high value to many users, but if it allows word processing functionality to be built into other applications, it may offer some advantages.

3.1.5 Groupware

Collaboration is supported at many levels. This can be supported by Web products which allow information to be shared effectively amongst a group<39>. Products such as Lotus Notes can be developed to provide a common platform, i.e. everything communicates with the platform. Other products, by allowing applications to communicate with specific others, provide a virtual platform. Data distribution from a single application e.g. project scheduler updates<40>, can use either email as a platform, which has the disadvantage of losing all the structure associated with the data, or local copies of the software application itself, which raises costs.

Communication may be amongst equals i.e. everyone sees and contributes to everything, or amongst specialists i.e. each contributes a specific element which then needs integration into some whole. The composite product of work has not been clearly defined. It is not a document, the present standard vehicle, but is probably a multimedia database, customized search tools, applets (which are realizations of models) and text. Without a clear picture of this development of groupware is hindered.

3.2 New products created by the existence of the Web

This is the most dynamic part of Web software: new products appear in hundreds every month. Some of the requirements in the latter part of this section do not appear as yet to have any satisfactory products addressing them.

3.2.1 Web sites

The fundamental element of the Web is the Website. This is a hypertext structure composed of a series of pages, linked in a variety of orders; usually any page at the site can be reached without traversing all other pages. A page may contain text, image, sound and video. It may also contain applets, code which can be transferred to the user computer and executed there if the appropriate environment exists.

As a repository of information the Website is no different from any computer facility for storage and retrieval. The apparent presence of the owner of the Website can make this a marketing and service facility. The evolution of the Website is through the addition of elements which enhance the virtual presence.

The costs of a virtual presence in a virtual marketplace are very different from those of a physical presence at an actual location. There are savings such as physical store costs, strikingly reduced inventory costs, personnel costs, advertising of presence costs, opportunity costs of choosing one location over another and the costs of physical transactions. There are new costs and new types of cost, such as Website rental, Website construction and maintenance, shipping costs for physical goods, virtual transaction costs and advertising costs for virtual presence. There are issues which have to be addressed and which may result in new costs e.g. handling return of physical goods, worldwide competition.

3.2.2 Web pages for Customer Feedback capture

Web pages have not yet been grasped for their significance to collecting information for companies<41>. A survey<42> stated that only 17% of the top 100 US companies replied to email from customers. Where they do responses tend to be poor. Apple Computer referred an email to its toll-free customer service number.

The cost of providing support is high e.g. L.L.Bean found it took 9 people to handle about 500 email queries per week. The tools needed, because most queries will tend to be similar are a database of questions and responses, and a means of assembling, under the guidance of a person, an appropriate response. Once experience has been built in doing this the system can be made more automatic and eventually might allow an expert system to prescan messages and to respond automatically to those which match certain templates.

3.2.3 Tracking tools

There are a number of Web tracking tools available<43>, which offer a view of the exposure a Web page is obtaining. This is a level of feedback which cannot occur with regular advertising, which depends on post-exposure surveys for its information. The kind of information collected includes who the visitors are and how long they are staying, what they do while they are at the site, what activities they abort before completion, what engagement is achieved e.g. placing names on mailing lists, downloading samples.

The tools do not identify why the visitor reached the site, what they were looking for in the first place. This information will exist in the search engines which lead to the site contact, if that is the method used. No cases of such integration were found i.e. the analysis is site-centric and not user-centric.

3.2.4 Indexing

Users who get frustrated by lists of possible responses to their queries can use a point and click approach to information searching, which uses indices which have been assembled by editors, who search the net for appropriate material. One such product is LookSmart, from LookSmart Ltd, an Australian subsidiary of Readers Digest (See www.looksmart.com). Another approach is to provide other indices which package information accordingly e.g. Yahoo!'s Get Local service responds to a zip code with a page of geographic information relevant to the area. This type of service can go as far as building custom indexes for sites of possible interest e.g. HotMap at www.documagix.com.

An alternate approach to the same problem is to build profiles on information needs and then to get a monitor to search for appropriate locations automatically. A product of this type is Intelliserv (www.cognisoft.com).

3.2.5 Web Broadcasting

The Web may be used for broadcasting information. A number of services are being offered based on this, but the products on which they are based are accessible to anyone to provide a public or an in-house service. There are various models of service which offer a slightly different range of options and capabilities<44>.

One approach is to use the screen-saver concept and to provide news information in the essentially dead-time of the computer i.e. if the computer is inactive and the screen-saver appears then the computer is deemed available for receiving broadcast information. The information may be truly broadcast i.e. all recipients receive the same material at the same time, or it may be directed i.e. the recipient has provided a specific profile of what they wish to receive. When the material is more or less requested, then there may be permissible ways in which a flag can be set to show the recipient that there is material available, similar to an email waiting flag.

The issues raised about security can be addressed through firewall techniques e.g. proxy, to ensure that there is no unauthorized reporting back of information to the supplier. A key element of any version of this is that the system accurately senses the use of the computer and acquires only those resources which do not compete with the main use being made. Another approach is to download information to the computer overnight and allow the user to determine when and if to pull up the information that has been delivered.

3.2.6 Search and Retrieval

The search engine takes a search request from the browser and looks for entries in its indices and produces a list of appropriate references back to the browser which can then move through the identified Websites. Search engines can be made domain specific. This gives them both performance advantage and functionality advantage. They can also be used on local data supported on an intranet.

Where the search request is broad a number of strategies can be used to reduce the scope of a search to areas which are more likely to meet the user's requirements. These include:-

1. use of knowledge of searches for other users to identify targets and refine search methods (popularity, annotation(based on previous user interest), match, reinforcement learning re value of downstream pages.
2. filtering by using the known interests of the specific user and matching to similar user experience.
3. decision making based on group characteristics e.g. analysis of informal data stored in Lotus notes and looking for matches to this. I.e. automatically generates requests and provides augmentation of existing information resources.
4. staged searching i.e. identify a pool of relevant data bases and direct enquiries for specific knowledge into these.

3.2.7 Browsers

Browsers are one of the staple tools of the Web. Whilst the Web has been a dominantly North American, English language environment nearly all major products assume an English language interface. When another language is required there are in some cases versions. However this does not address the problems of non-English, non-alphabetic sites. Where a site uses ideographs for text these may be garbled unless they have been prepared as graphics, with consequent time and space impacts. Asiasurf is a product which will allow documents in Chinese Simplified, Chinese traditional, Japanese and Korean to be read. (www.dynalab.com)

3.2.8 Meeting support

Meetings take a substantial amount of time for both managers and professionals in organizations. Some of this time is in travel, within buildings or outside, some in meeting inefficiencies e.g. waiting for the group to assemble, and some in indirect areas such as rework required because a meeting was not scheduled early enough to make a needed decision. The Web offers the opportunity for meetings to held from each individuals place of work and to use computer facilities to improve efficiency. Meetings can become non-real time as well. The range of needs<45> to be addressed includes:-

1. Information overload, particularly from brainstorming sessions, which have variable value associated also.
2. Lack of a collaborative vocabulary; same term, different meanings: different terms, same meaning.
3. Pressure to synthesize tasks i.e. move from raw input to actions, plans.
4. Sensitive topics and lack of trust

One approach to this kind of problem is to use an intelligent agent. An agent is intelligent<46> if it is:-

1. Integrated i.e. understandable, consistent interface.
2. Expressive i.e. accept requests in different modalities
3. Goal-oriented i.e. agent develops goals
4. Cooperative i.e. user may split functions with agent
5. Customized

These requirements may be shared by search engines and other Web tools. A product which met this type of requirement would be beneficial.

3.2.9 Telecommuting and teleworking

Telecommuting and teleworking have been proposed for a number of years to offer an alternative mode which reduces stress on workers and allows a more even participation in the workforce. Large organizations have not adopted this to a great extent but there have arisen some cottage industries which allow individuals to perform certain outsourced functions from their homes.

The Web offers the potential of a single interface for this kind of capability, and allows individuals to form virtual organizations. What support do virtual organizations need? To turn them from being collections of individuals some corporate assets need to be created: these assets might include:-

1. Institutional memory
2. Tools to support work
3. Self-reorganizing information repositories (including capture)

These needs are not different from those of a real organization: the shift is in using the Web to share these in a controlled fashion. In one sense a virtual organization is characterized by a quality, rather than a physical condition. Virtual means a closeness of sharing. In this view the products developed for telecommuting would find use on corporate intranets for non-distributed use.

3.2.10 Home Services

There are a mix of requirements for home services which have been noted. Some of them can be addressed through finding information on the Web, but the possibility of ease of use tools and information capture seem to be under-addressed, particularly in the integrated sense. As noted previously, a main use of the Web is for communications: filing and sharing multimedia communications is a potential consumer growth area. Other home uses include:-

> games, recreation, education, school work, news, information, travel planning and review, recreation, record keeping, banking, financial management, shopping, and cash management.

The largest opportunity is to address all these within a coherent framework. What must be evident is that some distinct benefit accrues through the use of the tools. Benefits may include obtaining best value for money, or increasing the range of choice.

Ease of use and support are important factors for the home. The following table<47> of sources of help shows where help is found at present. It may be interpreted as indicating the difficulties inherent in obtaining formal support, or as the lack of need for such support. However, this is for the early adopter population: later adopters may demand more formal support.

Sources of help	Parents	Teens
Self i.e. trial and error	34%	78%
Social network i.e. friends	21	63
or family members	60	48
Formal local support		
Virtual school	57	46
Local access provider	19	20
Training session	26	2
Formal national support		
Modem provider	9	0
Computer manufacturer	8	2
Software publisher	21	7

3.2.11 Management products

The browser is an approach to managing and monitoring information systems. The advantages it offers are its platform and implementation independence so that a single tool can be used for all of an organization's applications<48>. This also offers a low-cost approach both for implementation and for learning how to use it, as it is based on standard tools. It may also be possible to augment this into a user help facility to front-end the help desk, or to escalate problems from local to vendor support. The requirements are for the software modules that allow this total approach to be supported.

<u>3.3 Security Products</u>

If organizations are going to support their own sites on their own hardware then some security features are required. These can also provide buffering between the Internet and a corporate intranet. The requirements for such products have extended with the increase in interactivity of Web products with potential for automatic download and update which raise the possibilities of virus infiltration and information leakage. There have also been reports of security breaches arising from implementation features of software e.g. many products use caching to improve performance by avoiding accessing the same data twice. With multiple users through a single server, this has allowed one user to access another's cache<49>. This raises issues of how is a user space guaranteed to themselves alone, whilst allowing sharing of data when required.

The numbers of sites using full security appears to be limited. One general security protocol, -Secure Socket Layer, from Netscape-, was in use at 10% of sites surveyed and only 0.5% used this protocol with the digital certificates which complement it<50>.

3.3.1 Firewalls

Techniques used vary and include filtering i.e. inspection of each arriving packet, proxy techniques i.e. the download is assembled in a controlled space rather than in a live application, and address verification, to ensure that information comes from an authenticated source. See Centri Firewall 3.1 (www.globalinternet.com)

3.3.2 Reverse Firewalls

Because there have been cases where corporate employees have accessed private materials using company facilities, there is a concern about how to control this. The worst cases are associated with illegal activities e.g. access to child pornography. There is some perception that a requirement for censoring capabilities exists similar to those which block home access to undesirable sites. Some estimates have been made that 30% of corporate access to Internet is for non-business purposes<51>.

3.3.3 Encryption

RSA produces encryption technology which has become key to many secure transaction systems. The pivotal role of this company is shown by its ownership of small stakes in CyberCash(3%) and Netscape(1%). At the end of 1996 it was estimated that 90 million copies of RSA's software were currently in use<52>.

Security software is in use for privacy reasons, for protecting confidential data, and for authenticating sender and recipient in transactions. The product has potential for incorporation into fax systems to provide a secure fax capability. The relevant standard which is being adopted is S/MIME (Secure Multimedia Internet Mail Extensions).

3.3.4 Authentication

Forrester Research Inc.<53> believe that this is a critical part of any secure transaction scenario. At present there exist a number of competing digital certificate products. This will create a certain period of chaos until a single product, or a limited number of products, dominates. The certificate is issued by a third party, who must be considered reputable and secure. The third party holds a data base of information about the party for who the certificate is to be provided. Encryption is used to protect the contracting parties' information from all save those to whom the key has been properly issued; this is usually a public key/private key arrangement. In principle large businesses can handle their own authentication, but it seems to be preferred to use a specialist third party service<54>.

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3.4 Ease of Use Products

3.4.1 Turnkey systems

Turnkey systems have always been sought to allow small businesses to make use of facilities without requiring in-house expertise. Interjet connects to an Ethernet LAN and provides Internet connectivity, email, Web publishing and firewall security via a built-in 28.8kbps modem. This will automatically configure and maintain itself (http//www.whistle.com).

Instant Internet is a similar product but is equipped with monitoring capabilities to allow link use and performance to be monitored. (www.perftech.com)

3.4.2 Chat room construction

Chat rooms are seen as a popular feature from Internet which can be added to Web sites. The software to do this provides for the basic room set-up, but can also provide screening of inappropriate language and tracking of visitors for follow-up. Rooms 3.0 is one such product (www.ichat.com)

3.4.3 Retrieval engines

Because of the large volume of information which can be potentially accessed by standard search tools, and because of the way sites have engineered the indexes to ensure multiple hits, more sophisticated tools are needed to access high quality information. Packages are designed where there are likely to be multiple requests for essentially similar information e.g. updating. Search engines can be made active i.e. allowing for specific search or filter criteria to be written in a programming language such as Java. (See NetResults at www.innotechcd.com)

3.4.4 Web page construction

The mechanics of Web page construction can be simplified by such tools. Some allow a simplified language to be used which converts into HTML, or allow applets written in Java or Active X to be integrated. They can also allow access to databases and collect data about visitors. See Cold Fusion 2.0 (www.allaire.com), WebMgr (www.durhamweb.com/webmgr), Claris HomePage, Microsoft FrontPage97.

Microsoft's Internet Assistants convert Word, Excel, Schedule+ and PowerPoint into HTML documents for either Internet or intranets. This is included with the products themselves. Where data is to be captured from a Web page then a database entry form can be provided which will automatically include the HTML codes.

3.4.5 Document Management

A document may exist in various forms e.g. text, Web page, email and fax. It may also have audio and video components. To avoid losing track of the variety of forms of a single document integrated databases and conversion systems have been created. (See InfoPress at www.castelle.com)

Document managers may also be treated as a form of security, distributing information to an approved list of recipients and restricting access to others. Products such as Intranet Suite 7 from Open Text, provide audit trails for both access and change records.

3.4.6 Storefront Software

Ease of use systems exist to allow the inexperienced to build a business on the Web. The products support inventory and cataloging, order taking and invoicing. They will also collect information about customers to allow the business to focus on repeat opportunities. (See Netconsult at www.intershop.net)

3.5 Analysis

The products described in this section can be classified according to the primary function that they provide.

Extended data access	21%
Change in work process	46%
Security	15%
Utility	10%
Other	9%

On the basis of this sample, the chief focus is on new ways of doing things and not simply on data access. The lower count for security products may be because these are at a lower level in the Web i.e. not the direct user application, and address difficult problems with a high need for standardization, hence requiring a high investment in knowledge.

3.5.1 Trends

1. Integration through the Web is blurring organizational boundaries. Partnerships on the Web are doing the same thing.

2. With existing products, developments are piecemeal, mainly data focused, which is a limited view, and do not have clear models of use e.g. to show the benefits that may be derived. As one case, the Website is in continuing evolution as different functions are tried on it.

3. Many single user products are being developed for organizational use: this shows the inadequacies of the basis of the tool design and a deficiency of integrative capabilities. No clear targets exist for replacements of paper documents as an end-product. For example, the security trend is to provide limits and controls over the use that can be made of the open Web system in a closed environment. The management issues may not be understood.

4. The development trend has been to enhanced functionality, which leads to smaller and smaller users for each new tool addition. The new trend is towards increased resource i.e. data, sharing and communication, reuse of knowledge, processing power (e.g. through

external searches)

5. It appears that twice as much work is in developing new capabilities as in enhancing existing ones. Ease of use is also critical.

6. Tools for measuring use of the Web remain site-centric and not user-centric.

7. Security tools show the trend to specialization either through the provision of special purpose software, or through third party service engagement in transactions.

8. A trend is to make easy to use versions of products as soon as stable definition of function and operation has been reached.

9. The push approach to information distribution has been espoused as an alternative to pull. This effectively allows a search engine to continuously report on matters that the user has identified as areas of interest. It does not guarantee scanning the whole Web. This implies that for effectiveness the Web needs to know more about the user.

10. The value of information obtained is also questioned: screening mechanisms, Website endorsements and direct matching i.e. independent multiple sourcing, are all considered as viable approaches to address this. In parallel with this the economic approach of requiring information to be accessed through a publisher, who screens and charges for information can be adopted.

3.5.2 Issues

1. If the Web is regarded as a large data-store, then any data driven process can benefit. However, without control over the data source there are issues about replicability of a process, unless the data is copied, in appropriate context, to the local site. This results in data management requirements for the imported, multi-structured materials. This type of requirement does not seem to have been addressed.

2. Implicit in the redevelopment of software is a sense that there are better ways of working than existing software allows. A software package has a built-in view of how a certain task should be performed: the boundaries of the package define the boundaries of the task in the implementer’s view. For the novice this is helpful because it offers an easy way of becoming relatively proficient at a new task. For the adept, the task view may fail to match their view, or may impose limitations on change.

Because the Web is offering new ways of working the tools are likely to be more fragmented, so that they can be mixed in novel ways to achieve a user goal. Hence there may be more value in tools which are narrowly focused than those that address a whole preconceived function.

As an example, the field of document management may be radically revised when the view is imposed that documents are not the goal of the process. If the Web is a vehicle for communication, then the serial word + diagram + image document will be broken into its components, video, audio and operational elements added, and management of this becomes an information-bite management problem.

One tool needed is a communication logic map, which is not necessarily linear, which defines how information-bites shall be assembled to provide a certain communication. This shifts the whole granularity of the problem and requires management of relationships (individual and collective or assembled) between information-bites as well as of the entities themselves.

3. It has become apparent that some Web paradigms are already disappearing. This is not because of utility changes but because of environment changes e.g. volume. Search engines are constructed on the premise that all locations on the Web can be searched in response to each request. This is no longer conceivable since the number of Websites is growing tenfold per annum at present, the directories to Websites have become unwieldy (and corrupted by flagrant misuse of indexing terms) and the returned lists have too many entries. A number of intelligent search strategies have been proposed and the issues of indexing and searching have been noted as areas of opportunity for Artificial Intelligence<55>.

4 Changes in Software Design and Implementation caused by the Web

This section addresses the changes in the way in which services are delivered and the way in which software is implemented. This is the system view as distinct from the application view presented in the previous section.

4.1 System Software

Key problems are addressing where the boundary between system and application exists. The boundary continually moves as system functionality requirements increase. The evolution depends on the set of functional applications e.g. data management, search, presentation services, which are developed independently. The most successful of these then get incorporated in the system. To some extent the security products described previously could be integrated. The integration process is attractive to the system vendor because it justifies a higher price for their product. It is also attractive to applications developers because it guarantees them access to certain kinds of functionality i.e. higher level platform on which to build, with consequent productivity benefits.

The downside of this is the de facto standard creation, and increased demands on system storage. The latter has not appeared to be a significant problem for new system buyers because the decreasing hardware costs have more than kept pace with this. It does limit the lifetime of older systems which cannot be economically upgraded to employ the enhanced functionality. Neither of these negative effects is strong enough to inhibit ongoing integration.

4.1.1 Integration of Server and Operating System

The server environment is seen as an extension of the operating system and benefits accrue from integrating these so that the one set of code can be used for housekeeping and other common functions. This should also provide performance benefits.

For example, Lotus reports that Domino 4.5 for Solaris SPARC and Intel Platform Editions has been upgraded to provide tighter integration with the Solaris operating environment in order to better utilize native Sun event logging, fault recovery, and high availability features. As part of a new offerings Lotus and Sun will soon release NotesPump, a server-based data transfer engine designed to enable high-performance and scalable exchange of data between database management systems such as Oracle and Informix; Domino.Action, a set of tools that enable users to create and manage Web sites; and Domino.Merchant, a secure e-commerce solution for conducting on-line business.

The Windows NT server is another example of this phenomenon: it is rapidly encroaching on a market currently dominated by Novell's Netware. IDC Canada reports<56> that 70% of companies with a LAN use Netware and 20% use NT: the NT number is expected to increase by 50% in one year. One motive is that integration is attractive to companies trying to control network costs.

4.1.2 Complexity

System requirements become more complex because of the variety of interactions that need to be sustained in the networking environment. The extent to which a remote autonomous system can demand resources from a local system needs to be defined. Intranets can permit less stringent checking on interactions between members, than can be allowed for transactions across the Internet. In either case users wish to be able to choose what level of interactions they will support. Systems need to provide a range<57> of options:-

1. Send data to recipients at the sender discretion.
2. Make data available to recipients for access when they wish. This may be supplemented by a notify function when there is something to obtain.
3. Update to multiple databases on networked machines.
4. Extract from multiple databases across a network.
5. Message passing between objects across a network.
6. Access to remote functions.
7. Maintenance of single image for multiple databases across a network.
8. Display access across a network.

Complexity arises from redefining the extent of the autonomy of users, if they wish to participate in a network. This is as true of working as of software.

4.1.3 Tool consolidation

This has occurred in the office environment by packaging word processors, spreadsheets, presentation tools, etc. into a single suite, which communicate easily with each other and share internal data formats. Similar functionality bundling occurs in packages which integrate server software, search engines, data bases and project managers. Packaging may link business process reengineering tools, modeling, workflow analysis and application developers, and even packaged basic applications. Some of this integration is predicted to occur through the consolidation of tool vendors<58>. The Gartner Group are predicting there will be only 8 to 10 vendors in this field by 2004.

4.1.4 Traffic reduction

Although hardware is available to provide very large bandwidths for the Web, it is clear that only limited short term improvements will be seen. The huge growth expected in users will absorb all the increases in capacity presently planned. Accordingly there are opportunities for both data compression and for reduction in transmission requirements. Data compression mainly occurs at the server or router level. Some reduction occurs through the use of more efficient protocols. Other reduction processes are planned either at the server or within an application.

Some approaches reduce the number of requests and others the number of responses. The page structure at Web-sites inherently reduces transmission requirements by allowing users to select only those pages that they believe are relevant to their need without viewing the whole site. Standing requests for updates reduce the numbers of requests but could severely increase the number of responses unless some verification takes place that the requested data is still needed.

Accessing information at a remote site only when it is needed, rather than receiving every update is a strategy which is useful for frequently changed entities e.g. mailing lists. In essence the strategies entail knowing something about the use of the data being transferred and responding on a just-in-time basis.

4.1.5 Price Reductions

As hardware prices fall markets generally expand, but software prices must fall also for the full benefit of the expansion to be realized. For example<59>, Cisco is producing a MicroWebserver, for $995. Abovenet, and ISP, will then offer Micro Webcondo with up to 100 sites at $99 per month. It is this technology which will make the growth to 10 million Websites in 1997 a possibility.

4.2 Hardware related changes

This software divides into two clusters. The first group address increasing accessibility through a largely economic approach of finding lower cost devices. The second group are making the Web a common vehicle for information by providing access through a diversity of terminals.

4.2.1 Network Computers

Network Computers depend on a server to provide support to low cost, low function terminal devices. The
Network Computer typically has a relatively small memory (2MB to 16MB), no hard drive(though some stations support this as an option) and built-in browser. The benefit which is expected from such devices is not the low capital cost but the low maintenance cost, with little software to be updated apart from the server. Shipments of such devices may be as high as 10 million in 1997<60>. The costs of operation have been estimated by Sun to be $2,500 per annum vs. $11,900 for a PC in a network<61>. The highest estimate is by Gartner Group at $13,000 pa<62>. This cost is broken down into:-

> 21% for the computer and the share of the cost of the network
> 36% for administration costs, including planning and help desk
> 43% for lost productivity of the end-user.

This last number is an opportunity cost, rather than an actual penalty relative to the unmechanized state. It could also be construed as unused capacity.

IBM have estimated $3,144 per annum for the NC vs. $5,713 for a PC and $2,535 for a text terminal: this supports the view that aging text terminals, of which there are about 30 million worldwide, may be the target for replacement rather than PC's.

There is the capital cost issue for the servers required to support sizable networks of such NC's. These are expected to be significantly higher than existing server costs. Sun is proposing a server at $200,000. In addition the high dependence of the NC on the server may require faster communications and the associated higher cost of this.

Network computers may be used where low cost and fixed functionality are appropriate e.g. health care electronic form submission in health care provider's offices, tracking of shipments in warehouse and retail stores.

4.2.2 Net TV's

A related development is that of the box which can be added onto a standard TV to provide Web browsing capabilities. Such a device would be cheaper than the network computer and would download its software over the network. The assumption is that it would obtain its service via the cable network.

This might compete in the games playing and shopping markets, but whether it offers anything convenient to use is a key issue. It has been noted above that the existing Net users are relatively high income and it is they who have disposable income and a desire to use Web supplied services. They already have one, or in a significant number of cases, two PC's. This device might have appeal to a low-end market which would have very limited use for it. Fewer than 50,000 units had been sold by year-end 1996<63>. New marketing approaches may change this e.g. the inclusion as a feature of a condominium development<64>.

A different approach is to treat information and entertainment sources as one and allow the browser to access either TV programming or news and entertainment services mediated via the Web<65>. This may be charged for services, or may be paid for via directed advertising. In the extreme case it has been proposed that Internet, which would carry both radio and TV<66>, may replace broadcasting.

4.2.3 Net Pagers

These devices allow some level of integration between the pager and the Net to allow email as well as voice messages to be accessed. The focus of the approach is the integration of communication to overcome the existing fragmentation, particularly for those on the move. See RAM Mobile Data at www.ram-wireless.com, Motorola at www.mot.com/pagewriter, or SkyTel at www.skytel.com.

4.2.4 Phone interfaces

To enhance the usability of the Internet, products which interface to a phone have been introduced. These will allow a user to have email read to them over a regular phone e.g. Millenia Software's Email Reader<67>. This product will also allow a user to send a canned message in reply to a received message. It is planned to allow for full dictation. Other systems integrate email and fax retrieval over the phone line. (See Web-On-Call at www.netphonic.com)

4.3 Languages

It is apparent that there are numbers of modeling languages and authoring tools, of which VRML is one, which are effectively domain specific. These, together with libraries of objects, form a high-level platform on which productivity should rise significantly. It is not clear from information reviewed, how reliable these products are and whether they help in the creation of error-free software.

4.3.1 Java

Java is seen as providing an adequate software building environment, though it does not meet all requirements. It has a number of enhancements planned which will meet the most significant shortcomings e.g. native database access, asynchronous I/O and faster execution speed for compiled applications. It is also evolving the features that will allow it to become an appropriate tool for constructing secure environments. True portability does not yet exist, even though it has been promised.

It compels an object view and will, for appropriately trained programmers and correctly structured environments, offer productivity benefits and quality benefits (because of reuse). There are issues about the lack of standards for Java and about its performance in critical parts of systems<68>.

The speed issue is seen as the most critical problem as far as Sun is concerned<69>. Sun plans to enhance the technology with four products which will provide options for different situations:-

1. a just-in-time compiler which analyzes byte code and enhances performance on the fly.
2. a native compiler which will provide machine code permanently
3. a drag and drop technology which will mask Java from programmers and still let them assemble applications
4. pre-built applications which will execute in the Internet environment.

Java has been put forward as a way of achieving platform independence, though in practice it may fall short of this. However Java by itself does not offer true independence and there are issues about how independent you really wish to be. Oracle has a forms product for use with databases which it has structured so that the presentation, application and database layers are separated. The use of Java allows the presentation layer to be consistent with the presentation style of the platform on which the application runs: the application part and the database part are essentially identical code in all environments. The overall goals of this layered approach is that migration to the Web from a client server environment is easy: effectively the Web is classified as a thin-client world<70>.

The benefits of Java are seen as<71>:-

1. Elimination of fatware
2. Rental, not owning, of applets
3. Implied ability to identify and integrate applets to meet needs.

Before this last benefit is realizable there needs to be a software tool for configuration of such applets. This may be software opportunity.

4.3.2 Active X

The press coverage of Java and ActiveX shows an outstanding lead for Java. From this view point there is a strong probability that Java will become the dominant standard in this area.

4.3.3 VRML

Virtual Reality Modeling Language is a tool which will provide a visual environment with which users can interact. The language is rich in concepts and constructs such as proximity sensors which allow an environment to change simply because there is a presence. There are many companies working in this field, with some reference to a standard, so that a competitive environment may emerge. Although games are leading the way in this field it is possible to envisage business applications so that the immediacy of visual images can be used to guide users through complex choices.

The language is being used<72> to develop virtual versions of specific cities e.g. San Diego (www.planet9.com), architectural designs which can be walked through (www.mrabsi.com/contents_top_nj.html), and to support decision making (www.vdi.com).

4.4 Standards

The lifetime of many products on the Web is so short that standardization is too slow a process to work. Effectively a standard is set each time a group of companies agree to work together in a particular field. The care with which these ad hoc standards are defined is likely to be a major determinant in the success of the collaboration.

4.4.1 Standard Setting

Standards for Internet are set by the Internet Engineering Task Force (IETF) or by committees working under its auspices. Internet also depends on telecommunication standards e.g. for modems. The availability of standards specifications varies and there is no single source for them. The IETF standards can be accessed over the net at ftp://ds.internic.net/rfc.

When new products are created to work in the Internet environment then it is as well to determine what standards should be adhered to. This is not always done and the larger companies tend to be the greatest proponents of proprietary conventions<73>.

In some cases a leading vendor will gather together a support group of other companies who are willing to subscribe to a standard, which makes it non-proprietary e.g. Novell have proposed a printing standard which has support from Adobe, Hewlett-Packard, Intel, QMS, Sharp, IBM, Toshiba, Canon, Lexmark, Ricoh, Tektronix and Xerox<74>. Calendaring specifications do not have such focused support as Lotus, Netscape, Microsoft and others propose different options<75>.

4.4.2 Sources of standards information and Proprietary Standards

The complexity of functions being performed on the Net is increasing. Part of this is the nature of the functions themselves and part is the way in which they are implemented. There are few systems which are the exclusive domain of a single provider. Netscape Navigator, for example, is the framework into which a host of extensions fit, which enhance the basic functionality in terms of types of data that can be handled and the constructs which can be created. Gateways are used to provide ease of transfer of data from one environment to another.

Formal standards take time to put in place, and even when available do not necessarily provide all the capability that users and suppliers require. This has led to the proliferation of proprietary standards, which may be regarded as standards in the making, or as potential de facto standards. It has been estimated that there are 29 audio products and 19 video products currently on the market<76>.

There is an agreed product (created by Netscape and Progressive Networks) called Real Time Streaming Protocol, which will standardize some elements in audio and video streams. Microsoft have produced NetShow as a standard, which also addresses encoding.

4.4.3 Names

Names are an asset created by Internet and assigned by agreement. The ownership of names has been by claiming the name. The value is that names must be unique for the directories of the network to operate. In this they are like the asset of phone numbers in which the monopoly telephone companies effectively owned the numbering system and were compelled to provide numbers to their competition so that the network as a whole could be seamless. One approach is to increase the number of allocated top level domains i.e. the last segment of the name, and allow the individual part i.e. the second field to be replicated as often as required. This does not satisfy the trademark principle however. An alternative is the introduction of a new naming scheme.

The increase<77> in the number of allowed top-level domains will be handled via the Internet Society and the Internet Assigned Numbers Authority, which will effectively end the monopoly that the Internet Network Information Centre currently has on the assignment of domain names.

4.4.4 Objects

The field is still open on objects<78>: no one standard has yet been promoted. Netscape favours CORBA, but in general there is an ad hoc approach to ensure communicability between products and systems. Effectively the Net is still based on the exchange of documents rather than objects.

At a Web-site, whether for internal or external use, information can be stored in document fashion i.e. as a file store, or, could be stored as objects. The database vendors are creating what they call universal servers which effectively make documents and other Web elements into objects which can be stored in, searched for and retrieved from their databases. Each of the major suppliers<79>, IBM, Oracle, Sybase and Informix, have their own, proprietary solutions to this. Oracle is making some use of CORBA.

4.4.5 Performance Issues

In some cases although communication can occur across the Net it occurs slowly, or demands very high bandwidth. Java applets are one means of addressing this problem. There is also the pressure on producing better performing standards which can take advantage of current hardware technology. In some standards for example, data checking can occur at multiple levels, because when the standard was implemented there was no certainty that the network over which transmission occurred would have error correction built-in. Now this becomes an overhead in terms of processor time, memory space for the code to run in and volume of data transmitted because of check digits and redundancy codes which are added.

Another problem area is the way in which multiple connections may be required to transfer a single file transfer: some proposals have been made for improving performance e.g. Sun Systems have proposed the use of its Network File Systems (WebNFS). Sun estimates<80> this to be 10 times faster than HTTP in downloading files from local Internet servers, though not as fast as this over remote lines. As well as user benefit there is also load reduction on the network.

WebNFS does not address all types of transfer across the Net: it is a file oriented system and hence does not support dynamic page build-up. This means that the improvement it offers is in a specific field rather than global improvement. This highlights the key issue with standards: progress can be made faster with fragmented standards, but this increases the total number of standards required and will also increase the number of them that need to be incorporated into basic software such as operating systems and browsers.

This type of complexity can also be seen from the application side where products which convert text files to Web documents (HTML documents including embedded applets), have to accommodate the document types of the major word processor providers, publishers and presentation systems. (see HTML Transit at www.infoaccess.com)

4.5 Intranets

Intranets offer organizations the opportunity to use software developed for large end-user markets, which offer low acquisition costs. This may be a reversal of the usual trend where business use of computers leads the way for personal use. Intranets also recognize that corporations own a diminishing proportion of the data they need to maintain their business performance. The third element is the opportunity for external organizations to use the intranet to place orders, acquire and pay for information products and services, or to be influenced by marketing information. For example, when a company provides a checklist of the features of its product and makes it accessible, it provides an easy basis for a customer to analyze the alternatives, and because of the judicious choice of comparison terms, to conclude in favour of the company that provides the base information. A step beyond this is to provide an applet which automatically computes the answer when fed the appropriate data.

This can be seen as an instance of a general process of collaboration, which starts with a shared world-view, exploits common processes and makes best use of highly specialized information sources. This offers a new way of carrying out studies and analyses, by keeping the framework aligned with organizational needs and on the client intranet, and allowing the individual components of information to be delivered from best available sources.

Intranets are perceived as offering<81>:-

a) familiar interface which provides ease of use and reduces training time
b) document sharing and specialization access to promote high knowledge content
c) ease of distribution of applications because of standards
d) ease of access through Internet connectivity

However existing Internet software does not necessarily meet intranet standards e.g. for high reliability, non-stop operation of core functions. This software may also not meet the high-volume efficient performance objectives for both numbers of users connected and total volume of data stored. There is accordingly a two-tier structure emerging with Internet “vanilla” offerings available at low cost and high performance, high reliability offerings available at premium prices.

4.6 Analysis

4.6.1 Trends

1. The complexity of system software is rising because of increased functionality, and the

demands from a large set of collaborating, autonomous processors.

2. The industry structure is gradually consolidating as tool integration occurs.

3. Traffic reduction is seen as critical and is being addressed through changes to software, through compression, through protocol enhancement and through increased hardware capacity.

4. The development of Network Computers and Web TV's maintains the pressure on suppliers to keep reducing the price of full function systems.

5. The issue of operational cost of full function systems is being addressed through automated support, and management systems. The cost associated with the ineffective use of the existing technology i.e. the opportunity cost is not being addressed. Ordino's studies suggest that the achieved benefits from IT as less than 50% of what is possible. The other approach to the high cost of ownership, the potential for non-standardization across the network and the inaccessibility of some data to the corporation as a whole is being addressed through management software capabilities as an alternative.

6. New hardware interfaces show the ongoing trend of the Web as a single access point to function and data.

7. Software development trends are for platform independence and the use of high level descriptive languages.

8. The creation of an information asset on the Web is the creation of a business. Standards are key to this.

9. As documents diminish as entities passed across the Web, so object specification will gain in importance. This does not address the issue of what the output of work is in the shared environment if it is not a document.

4.6.2 Issues

1. The adoption of Web software into the business environment creates an upgrade requirement to achieve performance targets. It also creates boundary blurring as individual use tools migrate into organizations.

2. Because of the slow standardization process, requirements specifications tend to become de facto standards.

5 Changes and Opportunities in Marketing brought about by the Web

This section examines the use which is being made of the Web for software marketing purposes. As software is a special case, with benefits such as the ability to download the product over the Web which is not true of all products, some general trends in Web marketing are also included. Software distribution is changing rapidly outside of the Web influence. The low price of CD-ROMS has made them appear a better alternative for the reproduction and distribution of software than the 1.4 Mbyte floppy disk. In addition hard copy documentation is rapidly becoming a thing of the past, with documentation now embedded in the product or provided on a separate CD-ROM.

The other factor of change is the increasing frequency of new releases. This is not always a direct revenue increasing gambit, but a measure to match a highly competitive market place. All software vendor sites provide information about releases, patches required, and frequently offer access to the software in a trial mode, or, for a fee, the full version. This seems attractive but for most full products the download times may be considerable.

5.1 Prospect Identification

Products have been developed which determine whether a visitor is new at a site, and if so, treat them a little differently. They can alter the sequence in which advertising is presented, or they may offer a more enticing approach for frequent visitors. The Web has the capability of identifying who is exposed to material at any point and comparing this to a database and to respond accordingly.

This may develop further to use databases which include more than simple visit identification: they may be supplemented with general information about the visit based on the actual origin, or specific data if the visitor can be specifically identified. This may be achieved by using the equivalent of "AirMiles" databases

5.2 Demographic data collection

The Riddler gaming site allows visitors to compete for cash and prizes at games of skill. It offers the prizes in return for demographic data about the visitors and hence feeds a data base which can be employed for identifying targets for marketing programs. To extend the reach of the site a number of Web Publishers have agreed to provide customized versions of the Riddler games, which will carry the Riddler name. This serves two purposes, it provides Web page content and the potential for additional dwell time on the pages and hence exposure to advertising. The Riddler continues to acquire the demographics that it requires.

There are proposals to produce a rating system similar to that for TV. Nielsen is reported to be planning such a system jointly with a software company<82>.

There are ethical issues associated with the collection of demographic data. To avoid irresponsibility it is recommended that research is conducted openly, that respondees have the right to decline the addition of their name to mailing lists, and that resale of data should only be permitted with the provider's permission.

5.3 Exposure

Only a few Web sites can collect enough visitors to make the sale of advertising space lucrative. For smaller sites a barter system has been set up whereby one site will carry the banners of others in return for exposure of their banners elsewhere. This is being done at the Internet Link Exchange (www.linkexchange.com). The system is not entirely barter as the Link Exchange uses some banner space for itself and also places paid for advertising. Rates<83> are around $8 per thousand hits vs. $25 to $30 charged by search engines and $75 to $150 charged by C|net and Hotwired. One of the key measures of ad penetration is the click-through rate, which is a measure of the value of the advertising.

Email newsletters are another source of advertising revenue. These newsletters are sent on a regular basis to subscribers, who usually identify the news categories they wish to see. Advertising is included in the newsletters. (See www.tipworld.com)

5.4 Marketing and Sales Integration

Because the Web is an active medium it allows the potential transaction to be completed in the same activity as the purchaser saw the product i.e. the advertising and the sale are as close as the display in the real store.

5.5 Promotion

5.5.1 Attraction

Advertisers can promote interest by using interest items which may have usefulness or entertainment value. Usefulness is generally promoted to direct links to other pages that the users may wish to visit. Entertainment uses similar features to those in the press i.e. editorial, news, jokes and cartoons, letter pages, small ads, features.

5.5.2 Lead-in

The Web offers potential customers significant exposure to a product, particularly to a software product or to an information service. This type of initial exposure is always free: it serves to let the potential customer know how useful the product is, and hence the use of highly attenuated products in trial mode is not as good as providing full-strength versions for a limited duration. It also lets the customer know that they can use the product e.g. that it will run on their configuration. This also means that it must run and must not show any bugs so quality control for demonstrations is even more important than in the face to face mode.

The lead-in may be where a market is built e.g. the software in this release is free (the Netscape model) or it may be where the customer recognizes their individual need for the product e.g. games software approach. In some cases the software may be free because what the producer is selling is something else e.g. advertising embedded in the product.

The customer who reaches a Web-site and tries out a product should want to spread the information about the product to others, and to be positive about this. It would be possible to ask for the names of (email addresses of) others who might be interested in the product, and to reward this behaviour by extending the free use of the product.

5.6 Direct impact of Internet on Marketing

A major study in this area has been completed by IDG<84>: the seventh study in a series is titled, "The Internet's Impact on Corporate IT Buying - A Global Study. " This research aims to provide marketers with data-driven insight on:

- corporate buyers' vision and goals for the Internet-enabled enterprise
- the effect of the Internet on the technology purchase process
- how best to communicate with those who influence corporate Internet-related initiatives.

There were two parts to the study: a lead user review with nine major organizations and a 1,900 respondent survey conducted across the US, UK, Germany, France and Japan. The lead user study employed the perspective of Eric von Hippel<85> to identify the unmet needs for Internet-related products and services. The study determined that:-

1. The Internet's Effect On The Corporate End User Is Real And Significant. The Internet enables end users to access, manipulate and publish an unprecedented quantity of information.
2. The Internet Directly Affects Business Models And Processes. For example, Dell Online enables customers to configure and order PCs without any human intervention, saving Dell money and increasing customer satisfaction.
3. Vendor Requirements in the Internet World are for fast and flexible solutions, working effectively with other vendors, and providing a high level of communications and partnership. The Lead Users noted that vendors must provide products and services that enable their organizations to serve information to internal and external customers.

The quantitative study suggested that within a year over half the companies surveyed will be using the Internet. The key business objectives were ranked as to use the Web for marketing, to provide employee access to the Internet and to use Internet technologies inside the company. Questions about brand recognition showed that potential customers have very few preconceptions about what is available and hence there is likely to be a major education initiative by any vendor. This of course can be carried by the Web.

5.7 Analysis

5.7.1 Trends

1. Customization for individuals on the Web: this is data driven i.e. there is a need to know something about the individual. This creates a demand for data collection tools, which lead to data assets which can be resold.

2. Integration of marketing and sales is forming streamlined organizations

3. Direct and indirect revenue streams e.g. third party advertising, demographic data sale, knowledge sale i.e. if a business finds out how to do something over the Web, it can sell the generated expertise.

6 Changes and Opportunities in Product and Service Delivery brought about by the Web

This section looks at the way in which the Web can be a delivery vehicle for certain kinds of products, particularly the software related ones.

6.1 Software update for new releases and fixes

In the past software companies have used the product registration card technique to build a database of users to whom new release information should be sent. Such lists have also been provided to the producers of related products and services for whom the purchase of software automatically qualifies the prospect. Now companies can use Web pages to advertise the availability of updates and new releases, possibly accompanied by demos.

New releases of software, either whole new systems or new versions, and fixes to software are continuously appearing from vendors. As an example IIS (Internet Information Server) has been through 3 major releases in a year. (January, July and December release dates)In many cases these releases may be free. The fixes are often configuration specific and so require some knowledge regarding their applicability. Now one can download these changes over the Web and to do so a component is required which will determine what software is on a computer and what the configuration of hardware is, a component that tracks the status and availability of the software changes, and an installer which retrieves appropriate elements and install them as required, possibly subject to the explicit agreement of the user. See Oil Change at www.CyberMedia.com. A similar product is WebPatch at www.webpatch.com.

6.2 Automated Help Desk

The Web supports the emergence of highly specialized functions because it acts as a concentrator of demand through a single access path. This allows for a payback opportunity to exist which would not arise without the Web. One such field is that of help desk automation<86>. Many organizations rely on outsourced help desk functions but an automated option may be more cost-effective.

When a problem is reported it is compared to a data base of known problems and the fixes that match these. If a match is found then the fix is automatically applied. The service can function well because with a large base of users it will very rapidly gain a wide base of experience in its database. Some users, who are averse to unforced changes, will prefer this type of service to the previous one, where all fixes were applied automatically.

6.3 Information and Advertising

Subscribers to Information Services can receive their information either as email deliveries or by using the Web as a broadcasting, or point to point casting system. Unused space, such as screen savers have already been noted as vacant space that can be claimed for this purpose.

The techniques employed in this kind of delivery i.e. background operation may be used to advantage in downloading sizable files without tying up a system for prolonged periods of waiting.

A clearinghouse service has been proposed to allow payment for Internet Information services. This requires the consumer to determine that the sources produced in response to their request are worth accessing. When they access the returned information to an inquiry, a billing record is produced for the supplier to the consumer<87>.

Some companies are developing "self-service" centres which allow users to gain access to databases via corporate intranets<88>. This is one of the few counter-examples where a product has been developed first for the intranet regime which may have migration potential to the Internet milieu.

6.4 email

email is one of the paid for services which generate revenues for ISP's. Usually the email fee is bundled into the other service costs. Some alternatives exist which integrate email with the Web. Access to a server site provides access to email. This offers a degree of anonymity that some users will pay for e.g. at a rate of $20 per annum. Another approach is to make the service free but to include advertizing with each email message received. One service doing this is Hotmail<89>

6.5 Paid for Services

If revenues are to be generated via the Internet, some means of collecting revenue is required. In the delivery of phone service the phone companies are in a position to do this via the infrastructure and so have created offerings such as 1-900 services. The infrastructure itself offers no such capability at present and so the revenue measuring and collecting has to be done on a distributed basis closely associated with the service provided.

NetCentric Corporation has allied with Compaq Computer Corporation to provide an integrated hardware and software platform that will allow Internet Service Providers to offer metered, pay-as-you-go services, such as Internet-based fax. Tandem are offering a similar capability using iTP Commerce Server.

6.6 Products

Products can be ordered and paid for through secure forms. This offers the close coupling mentioned previously and is preferable to requiring a separate phone call: there is a degree of consumer confidence yet to be obtained. One approach to this is the use of a mall concept, where numerous businesses can sell their products but there is one point for ordering and payment. It is not clear what the equivalent is for corporate purchases.

6.7 Business Support services

Concerns about the reliability of the Web for conducting transactions are frequently cited as the reason for not using the Web. Some of these concerns are being addressed through third party businesses. Key to success is The ability to impose only a small charge per transaction and to gain enough volume to be seen as reputable. In some cases the support of existing major institutions or businesses is used to achieve the reputation.

6.7.1 Agent assisted transactions

For some transactions there is a benefit if a customer service agent can be involved: this offers greater support to the customer and provides an opportunity to provide a selling opportunity to the provider. This can be done using technology which passes the voice interaction over the Web whilst the customer is also browsing the Web at the seller's Web-site. See www.lucent.com/Internet.

6.7.2 Banking for businesses

iSTAR is offering banking service support to businesses through iCOMMERCE. This has support from Scotiabank Toronto Dominion Bank and the National Bank of Canada<90>.

Another approach to this is being offered by IBM<91> where through a protocol called SET (Secure Electronic Transactions) information such as a credit card number will only be accessible by the customer's bank and the vendor will not know what it is.

6.7.3 Distribution

Purolator offers a service whereby customers can place an order through a form on their Web-site. This avoids the use of special software. In addition retailers can link their site to Purolator’s to arrange for the distribution of their products. This offers a potential restructuring of business: the manufacturer becomes the retailer through a storefront page and distribution is via a specialized service without intermediate inventory.

6.8 Web Business Enhancement

6.8.1 Business Transformation

Businesses which are at present focused on the delivery of a product are becoming changed when they start to use the Internet: they become information businesses which have an associated product. For example the book industry delivers a product, the book, but the real issue the industry faces is getting the consumer to identify what book they want. At present this exists through a complicated process of book writing, reviews, public presentations, book prize programs, advertising, and a browsing facility. The bookstore which is the ultimate customer interface is really a place where the customer can sample the product: hence the growth of the bookstore/coffee shop business.

If books can be accessed over the Internet, if catalogs can be searched directly by the customer, and eventually if the entire book could be shipped over the net, then the business is substantially changed. For example see www.amazon.com

6.8.2 Banking

Banking transactions can easily be moved to the Web. There are already on-line home banking capabilities and telephone based systems, but mostly these are unique to a single bank. IBM is looking to provide a standardized network under the name Integrion, which will offer common services using a variety of front-ends e.g. a browser, a commercial on-line service, a software package or a phone.

7% of banks provided Internet service in early 1996<92>, 17% intended to provide this by the end of 1996, 19% in 1997 and 6% in 1998, for a total of 49%. This compare to a total of 74% offering ATM service by the end of 1998, and 76% offering banking services by telephone. This shows that banking is clearly an opportunity area, both because of its plans and because of the early adopter leadership it has shown with other technology.

6.8.3 Insurance

Insurance is a product which appears to be natural for sale over the Web: the tangible form of the deliverable is only a piece of paper. The Centre for the Study of Insurance Operations, Toronto, is managing an intercorporate intranet, which will connect 30 insurance companies with nearly 4,000 brokerage offices. This is an example of an industry-wide collaboration occurring over an intranet. It will mainly provide access to already existing Web-sites. The benefits are the speed of access it will allow over dedicated facilities, and ease of access to the full set of Web-sites<93>.

6.8.4 Information Publishing

The Web provides new channels parallel to existing ones: this is particularly true for Content delivery. Some publishers and similar organizations provide both paper copy distribution, and access via the Web. There is no data to suggest how many clients choose each mode.

In paper media there has been pronounced segmentation: consider the number of magazines published each month. The Web offers further segmentation possibilities, both for subject matter and for user depth of understanding. This leads to the concept of the personalized magazine. Content is categorized by the supplier for topic and could be classified for level of expertise to allow users to select appropriately.

This can be a user paid service, but if the advertising model is used, then as a selection of items is made so appropriate advertising material would be inserted. This creates a refined equivalence to the existing paper world. No evidence of general software supporting this kind of customized content delivery has been noted.

6.8.5 Games

The Web offers a source of games which can be downloaded, as well as providing trial versions of games intended to encourage ultimate purchase. The enhancement that the Web offers is the ability to play with others in multiperson games, to access information and assists for game playing and to participate in leagues. In some cases prototype games are made accessible which allows the users to influence the final form of the game and the supplier to obtain early feedback about markets.

6.9 Web Business Creation

If the Web is used frequently for gathering information prior to making a purchase, then the most common form of new business is that associated with the gathering, standardizing and comparing information. As well as the automobile service described below there are ventures in real estate and holiday travel. Providing information for direct use offers opportunities in education, or in problem solving. Gathering information uses the Web for its reverse capability, and recruitment is one case: another is tendering contracts.

6.9.1 Automobile purchasing

Autobytel is a service which is subscribed to by car dealers, who in return for a fee can place their available product in a database. The purchaser can access this database freely and find the kind of specification desired and the price requested. If a selection is made the information is passed to the appropriate dealer who thereby gains a qualified lead, which is the return on their service fee.

Additional information is provided about leasing and financing terms and about other requirements such as insurance. (www.autobytel.com)

This product essentially creates a competitive marketplace and makes it efficient by ensuring that the purchaser can be fully informed. The same technique might be followed for any capital or durable purchase e.g. houses, computers.

6.9.2 Academic assistance

AOL has created an academic assistance centre. This is a series of chat rooms each staffed by a tutor. The number of chat rooms active at any time, varies from 1 to 10. The tutor role is to provide guidance about where students can find answers to specific problems. This simplifies their use of Internet in obtaining information. A similar process could be provided for any information inquiry, subject to the quality of the tutor<94>.

The chat room format allows the questions and answers to be seen by all participants which may offer multiple use of the same answer, or the stimulation of new questions and perhaps an expansion in the vision of the inquirer as to what they should ask. The fundamental software is simply the chat room. The auxiliary software required is that for analyzing the contents of the dialogue to provide a packaging of frequent enquiries, and the development of intelligent tools to support the tutor and to allow them to improve the quality of answers provided. Software to filter the questions, to ensure that they may make sense would also improve performance and quality.

For products in this area see key word "AAC" for America Online, www.elibrary.com for the Electric Library of Prodigy, www.click.toplinks, "learning", "Study hall" for a source list.

6.9.3 Service facilities

Web sites have evolved into intranets which provides the opportunity to share information within an organization. A famous example is the facility to allow Xerox technical support to share information about how to resolve copier and printer problems. As such sites evolve some companies allow customers to have access to them: the benefit may be reduced load on a help desk facility, or a better understanding of customer problems, or the development of sales leads. A further step may evolve when access to the site is a paid for service.

The key to this development is the existence of tools that will allow Web applications to be developed quickly and reliably. In effect they may always be in prototype mode because of the rapid evolution<95>.

6.9.4 Recruitment

Web sites are being increasingly used for personnel recruitment. This is evolving from resume submission by fax, to email, to Web form completion. 21% of Canada's largest companies are now using recruitment in one form or another over Internet<96>. Software to support this e.g. to provide multimedia testing environments to obtain skill scores, response analysis software, is not widely available at this time. The demand is yet in its infancy.

6.10 Analysis

6.10.1 Trends

1. The software maintenance chore is being reduced through a combination of intelligence and access to data and software patches.

2. Currently outsourced services are being mechanized, benefitting from a large user base, which gives many cases, and linking to the fix directly.

3. Linkage of information access (finding and delivery) to revenue for both public and private information (email).

4. Reputable third parties are developing services for transaction support.

5. Restructuring of businesses around a narrow specialization.

6. Redefinition of existing businesses in information terms and not product terms. Creation of new information businesses providing values through improved purchase decisions.

7 Changes in Business Process brought about by the Web

Two chief effects of the Web have been enhanced opportunities for partnership and coordination, and a further shortening of expected timescales. The former results in an increased focus on mergers as an eventual outcome of partnership. Because the Web is different from existing media, existing regulation does not fit exactly and so the Web becomes a proving ground for new and existing concepts.

7.1 Mergers

The Web is seen as a critical component of information publishing and distribution. Consequently many existing content providers are looking to acquire Web distribution expertise through mergers and acquisitions. CUC International acquired Sierra On-Line for $2 billion; Thomson Corp acquired West Publishing for $3.4 billion<97>.

In other areas companies with highly focused expertise are either acquisition targets by other companies who seek complementarity, or they seek complementarity acquisitions of their own. This has the effect of allowing businesses which are generating revenue flow to direct it to business development without a lengthy product development cycle. This in turn suggests that most innovation will occur through start-ups, with business success being defined as becoming a take-over target. This emphasizes the need for start-up investment, and, where current revenues suffice, reduces the need for development investment.

An estimate<98> of the venture capital invested in hi-tech in the US rose from $1.3 billion in 1991, a low-point, to $5 billion in 1996, with expected continued growth. Annualized the growth rate has been 30%, which suggests $6.8 billion in 1997. Current preferences are for software start-ups rather than hardware. On a 10% basis, $700 million might be expected as an appropriate level for Canadian investment.

Where a formal merger does not occur, then an endorsement (possibly with share purchase) is another approach. For example, Netscape has designated iChat for chat software provision. Netscape promotes iChat to Netscape customers: iChat will work within Netscape software products.

7.2 Responsiveness

The Web offers very rapid transfer of information: the various distribution mechanisms can ensure that a large community become aware of a fact very quickly. In the case of corporate information this creates a quasi-insider opportunity for trading in stocks, but with an advantage limited by the efficiency of the market resulting from such common information. For advantage to exist very rapid responses in trading systems are required, particularly if this kind of intelligence is collected automatically by a program able to issue trade requests.

Equally, awareness of flaws and loopholes in software is rapidly disseminated. In this case rapid response is required to fix such problems to avoid potentially catastrophic losses. A recent flaw in a Web browser was reported one morning and a fix was available late the same day, for distribution over the Web.

Hence all business needs to enhance its awareness of its products and services in use, using the Web as a means of monitoring, and to have a response capability to any identified threat or problem. In this case the use of the Web for customer feedback may be a very critical area for the provision of software and services.

7.3 Regulation

At present no specific Internet regulation<99> exists. There is concern that existing laws concerning the publication of offensive materials are not sufficient to control the Web-sites which offer child pornography, or material subject to copyright, including software. Some ISP's have taken unilateral action by refusing to carry such sites.

In "The Challenge of the Information Highway"<100>, there was a general recognition of the need to review traditional concepts of regulation and copyright in the new context. "Concepts such as copyright, fairly well-established in the world of print and publishing, are harder to apply in a still-unfolding digital world." (Page 9).

In Issue 8 (page 132 et seq.) the need for a model code of ethics and the need for filters to allow persons to screen out unwanted material, were both noted. The possible requirement for content control was not raised. However, either is a perceived vulnerability for ISP's, who on the one side do not wish to be liable for dubious content, and on the other do not wish to be seen as unfairly discriminating.

This does not appear to be a factor which is at present inhibiting the growth of service supply, but it could be a vulnerability in the case of a legal action being brought on either side identified above.

8 Characteristics of Web-based software business

8.1 The shared vision of the Web

The software industry has a view that the Web can be used for anything: it is seen as a connective environment, which allows a person to connect with other persons, with information, with environments or with applications. The Web is also seen as an integrating environment: it tries to make it possible to anything from a single point of contact. It offers alternatives: if you don't like one search engine, then try another. A key attribute of the Web is that it offers both computing and communication i.e. it is more than a large disk store.

In this milieu partnership plays a critical role. Some partnerships are between large organizations, some between large and small. The software business needs to possess qualities which will make it an attractive partner. This is addressed further in the next section of the report.

8.2 The keys to survival

To operate in this environment demands extreme agility. It results in short term projects with limited undertakings because long term projects are no longer viable when requirements change so rapidly.

It demands awareness of what others are doing. Plans need to be modified as new competitors appear from nowhere, large resourced companies decide to shift their focus, and partners go out of business.

It also flourishes in conjunction with hardware manufacturers: new hardware innovations demand modifications to software.

It requires platform independence.

8.3 Fields of operation

8.3.1 Putting existing capabilities on the Web

A wave of existing capabilities becoming "Webized" is probably a temporary phenomenon. The Web is offering new ways of doing business and is undermining in some areas the traditional advantage of established and large businesses.

The greatest long term opportunities are those which embark on a restructuring of individual work and business function. Conceptual paradigms such as the "document" will eventually be displaced. The technology vehicles to displace them exist, but the way in which the replacements will be structured and used has not yet been resolved. Education will play a large part in adoption where there is such a fundamental shift.

8.3.2 Functions moving onto the network

Work functions are moving onto the Web because it allows the use of low cost software, it allows sharing of information, and it allows customers or clients access to facilities.

8.3.3 Types of application

The Web works in both directions: hence one view of application classification<101> is based on the way the application is initiated e.g.

1. client-server, initiated by either client or server
2. two way applications e.g. chat
3. server controlled applications e.g. data distribution

8.4 Challenges

8.4.1 The new users

The new range of users is a fundamental challenge: growth in the Web user community means that many new users are much less aware of what the Web is, what it can do, and what computers are all about. Because the Web keeps adding new features, it has the potential to become more obscure as the users become less capable.

8.4.2 The specialist function

Naive "specialists" are appearing who use one or more Web tools to carry out a task which normally demands specialist training, knowledge or experience. For example it is possible for a non-specialist to track stock performance in very sophisticated ways, without understanding the steps of what they are doing. The software developer tries to make the product as explicit as possible, to train the user as they use the product.

This means that the product has two functions: it must deliver a capability and it must train the user about that capability. It must also train the user in how to use the package.

8.4.3 Diversity of requirements

Developers must simultaneously address:-

1. How to integrate all forms of communications
2. Need for security
3. Dearth of high-end visual tools
4. Configuration management and version control
5. Support for a flexible, sophisticated user interface
6. Common development environment

7. Performance

8.5 Issues

8.5.1 Scope of packages vs. scope of tasks

How much does the architecture of a package educate the user about what can be done and what options exist? This is outside the realm of computing options but addresses simply functional options i.e. how do you do your job. Is training to use the software an alternative to job training? This requires experts in the job function. Where the function is changing this requires advanced analytic and conceptual skills.

8.5.2 New forms of software development

Existing patterns of designing and building software with a view of long term maintenance and version enhancement may not be appropriate in the rapidly changing requirements of the Web. Is Web software effectively evolutionary<102>? This implies a long process of adaptation through many changes to achieve a stable entity. Adaptation may be through successive releases of one program or may be the adaptation of the features on one program into another. This entails knowing the competitor more closely than ever before.

8.5.3 Maximum program size

The issue with maximum program size is the rate of change of requirements<103>: in function point terms a program with 10,000 fp's will take about 40 months to complete. If requirements alter at 1% per month then the actual completion time is 67 months. As the rate of change increases and as the program size becomes larger so the actual completion time extends and rapidly becomes infinite.

Hence we need fragmentation of requirements to allow small chunks of code to be completed and which can work together with others. Therefore if requirements change for the interworking then this does not offer an improvement and so the internal standards are critical.

8.5.4 The role of Artificial Intelligence

Is AI the saviour<104> of the Web? "Virtually instantaneous and cost-free publication, inherent in the WWW, leads to problems with information overload."

One solution is to generate intelligent searches which bypass indexing: another solution is to create intelligent indexing. Either of these approaches leads to an increased need for AI.

8.6 Software Companies on the Web

A review of medium sized Canadian software business Websites has been undertaken to determine what use is small and medium sized Canadian business making of the Web. Websites for a sample of companies selected from the lower half of the Branham list of top Canadian software companies produced the following observations:-

31 sites were examined: 30 were in operation and 1 was under construction, so all companies had a site location.

16 of 30, 53% were Java enabled.
9 of 30, 30% offered downloads
4 of 30, 13% had guest tracking
29 of 30, 97% provided an email link
1 of 30 offered prizes
1 of 30 offered audio.

9 Strategies for success in Web-based software business

Survival may be based on having no significant predators: the Web is highly competitive and there are plenty of predators. Survival may be adapting to a niche for which there are no competitors: in a worldwide market there are few unique niches. Hence any strategy must be based on being able to compete.

9.1 Creating revenue in a "free" system

A number of strategies can be pursued to introduce revenue possibilities into an otherwise "free" system. One is to address niche requirements and produce highly focused products where there were none before, so that comparisons with the "free" past do not apply. Such products may be developed to address broader markets.

Another strategy is to adopt a premium approach i.e. produce a higher quality product (more reliable, better performance, enhanced functionality, greater compatibility) and address it to users who value these properties.

A third strategy is segmentation i.e. address only the intranet market, which is supported by corporate dollars and for which value is clearer. A possibility is then to migrate product from the intranet environment to the Web, which is the opposite of current behaviour.

The fourth strategy which has been pursued, is to generate revenues through other mechanisms than sales e.g. advertising, support.

9.2 Competitive factors

1. Supplier pressure is mainly from the takeover possibility by the supplier of the platform on which a new product is built. Options are:-

- sellout: this can be construed as success if the price is appropriate.
- platform independence is a mitigating factor i.e. the market is not totally lost in one step.
- building systems on top of the base product e.g. ease of use capability, links to other systems.

2. Buyer pressure is generally low: the opportunities are large and the skilled people are not generally available, whence the prevalence of outsourcing.
3. Threat of new entrants is dominated by speed with which new entrants are up and running, and the in-depth application expertise which is embodied in the product.
4. Substitutes are a low threat for non software solutions, but there are different conceptual ways of addressing the same problem which is part of the market dynamic e.g. pull vs. push. Again the keys are speed and expertise.
5. Existing rivalry is chiefly standards set up by the large organizations, either in proprietary mode or by common consent. This leads to need for intelligence i.e. what are the appropriate

standards, and what are their content.

9.3 Dominant factors in competition

1. Speed

Idealab, a company that starts-up businesses on the Internet in the US, has a target of concept to launch within 9 months<105>.

2. Expertise

This requires an in-depth knowledge of a critical area. Provided the area offers value to potential clients, then having a uniqueness can be a strength. Expertise which is too far ahead of the field will gain weak acceptance and be vulnerable to changes.

With the merging of Marketing and Sales business structures, the developer is effectively closer to the customer and hence more able to acquire the domain expertise of the customer to integrate into the software solution. This is demanding on the developer.

3. Vision

This means awareness of what is happening and what the possibilities of the Web are. Because no single organization can meet all the demands of the Web, it is important to see how all the elements of it fit together, and where the business's own domain is exactly.

4. Partnership

The requirement for in-depth expertise creates a classic conundrum for a business. If it is too narrowly focused then it is highly vulnerable to change: if it spreads its focus it cannot maintain depth. One way to address this is through partnership with a business which offers high complementarity. To promote this a business needs to be attractive to a partner. Some key qualities include:-

- expertise which provides a strong solution to a well-defined Web problem
- a product with revenue potential i.e. providing easy to identify value to a purchaser
- well designed product which is portable, meets all existing standards, and can be readily adapted to fit with the partner's products
- demonstrated project management ability to bring a product to delivery on time and on cost
- demonstrated ability to fix problems rapidly.

10 Conclusions

The overall trends noted below are synthesized from those of earlier sections: they provide some possible explanations of the earlier observations.

1. The Web is a powerful engine for integration. It brings together many services and also allows different organizations to work together. The integration can blur organizational boundaries: marketing and sales become a single streamlined entity. It also, through partnerships, encourages closer working of separate organizations with a resulting high rate of mergers. As products, particularly software development products, integrate, so the market will become dominated by a few larger players.

2. The Web is being built on available technologies. The need is for applications of this technology which provide value to markets which can pay. Intranets as adjuncts to the Web, and as employers of the same technology are a dominant market. The necessary changes are to increase performance and to meet organizational needs rather than single user needs.

3. At present the Web is IT. Whereas business was the leading user of IT, now individual use products are leading business in some areas. The leading area of innovation is doing new things not in improving existing ones. This is a harder sell to business than to individuals, which will make the Web more uniform. Much innovation is associated with the complexity of the Web, the autonomous elements, advanced functionality and sharing to achieve worthwhile value.

4. Growth of the Web depends on ease of use. Easy to use versions of established functions and operations follow quickly on acceptance of an original design. Software maintenance and installation is becoming highly automated.

5. If security were seen to be better, the Web would see more revenue related growth. At present security is focused more on limits and controls and not enough on enabling transactions to take place in a secure fashion. To address the wider security issues reputable third parties are being employed to provide services. This may only be a stage in development.

6. Revenues have become important on the Web. As soon as payments are required, delivered value becomes an issue, which leads to how the quality of information provided can be warranted. Diversity of revenue streams through advertising, the selling of associated data, or the sale of knowledge associated with products and services, are all blurring the sense of who is actually making money on the Web.

7. Much development has been piecemeal, limited applications to meet limited goals. The lifetime of a product is strictly limited. Some critical areas of how work is done on the Web, in terms of both product and process, are not supported by a good enough understanding. How are separate tools integrated, and how can the full resources of the Web be deployed, are questions without satisfactory answers. A key issue is what will replace the document as the central item in the Web world. Without this requisite understanding it is hard to ensure that

products provide value, and impossible to achieve any level of optimization.

8. The Web offers great potential for individual customization but the data about the individual is site-visit related and not individual focused. Along with this is an evolving market in data about individual consumers. This potential is hindered by lack of tools. This knowledge of the user is also present in the concept of “pushed” information.

9. For the Web to be a legitimate growth point there is the need for better performance. Performance is being addressed through basic facility investment, through a variety of strategies for reducing traffic, and through improvements to protocols.

10. The cost of Web access is a priority growth point, low cost alternatives for the PC are helping to drive down PC costs: the operational costs are being addressed through a range of intelligent software systems. These are resulting in what have been outsourced services being mechanized over the Web.

11. Software value on the Web depends on availability anywhere, hence the use of platform independence, low cost which drives high productivity software tools and methods, and a narrow specialization which demands collaborations and standards.

12. Information is becoming a real asset i.e. from which revenue can be directly generated, and this evolves through business redefinition in information terms. The values provided are either access to resources e.g. name registration on the Web, or through leveraging expenditures to get better value for money.

These trends are not all independent factors: nor are they all of equal importance. Together they do allow for a revised perspective on how the Web may develop.

It is clear that the Web has the potential to be the integrator of an increasingly diverse set of communication services and capabilities. The Web is not simply another element to be integrated but can provide the one platform through which all communications will flow. It is the actual point of convergence of computing and telecommunications which has long been recognized but which has never been so fully exemplified.

If the Web is to become as ubiquitous as this first point suggests, then it must become of much higher quality, more reliable and much easier to use.

If the Web's key asset, that of being able to offer a personalized service to all users, is to be exploited then the Web will need a great deal of personal information about the users for whom this personalization is being performed. To make this possible there must be a flow of information on both directions: from the Web to the user and from the user, about the user, to the Web. Managing this information flow, not eliminating it, is crucial.

Another realization that the Web offers is that of providing real, direct value for information. It allows us to divide business into the information part and the physical part. The information part includes all marketing activities by the provider, and most information collection activities by the consumer. The physical shipment of the product is a minor and mechanical part of the complete transaction. This offers the opportunity for economically efficient i.e. fully informed, markets, and challenges the whole way in which business is carried out and the way in which organizations are structured.

11. Glossary of terms

Active X	platform independent programming system
Applet	small application code providing function to execute typically on a recipient's computer
Click-through	means that an icon at a Website is selected and the promotional material accessed
Hit	a single page visited
HTML	Hypertext Markup Language: tool used for structuring information so that readers can choose the element they access next, possibly on another computer
Hypertext	index card based structure for information, which allows movement to any logically or physically related card
Internet	shared worldwide network of computer networks transferring data using the TCP/IP protocol
Intranet	computer network which serves a single organization, possibly allowing public access, which uses tools and techniques common on the Internet.
Java	platform independent programming system
Mbps	Millions of bits per second. A single TV channel is approximately equivalent to 35Mbps.
Object	a software entity containing a collection of data elements and the set of procedures which are the only valid operations on that data.
PC	Personal Computer
Router	hardware device for determining which of several telecommunication connections data shall be sent to
Server	computer equipped to provide services, including program execution, for remote users
URL	Uniform Resource Locator, standard addressing format for all Web entities
VRML	Virtual Reality Modeling Language, a descriptive or authoring language for describing an environment
Web	the collection of Websites accessed through URL's
Website	a collection f information organized according to hypertext logic, possessing a unique URL

Footnotes

1. This is based on material assembled by R. Cailliau, W^{3}C, October 1995. (Accessed via www.W3.org/pub/www/www/)
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