

Beyond Transaction Costs: E-commerce and the Power of the Internet Dataspace

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Introduction

The commercial Internet is now approximately six years old. What is most remarkable is not the speed at which it is being adopted, the rapid expansion of the amount of data flowing through it, or even the burgeoning number of new Websites; rather it is the extraordinary redirecting of talent and capital to finding ways to commercialize what had been an entirely noncommercial system. This wave of talent experimenting with new ways of generating and/or conserving value is powering a far-reaching burst of creativity that is transforming economic exchange. Our modest aims are to examine a few of the current developments in what the venture capitalists term "the Internet space" and reflect upon what these changes mean to the development of the current economy. As with any analysis of such a fast-moving economic phenomenon, our predictions and observations are based upon conditions and developments that might be rapidly outdated (Kenney and Curry 1999b).

Our central orienting theoretics are Schumpeter's (1969) metaphor of new technologies opening new spaces, and De Landa's (1991) work, derived from Deleuze and Guattari, on the self-organizing impulses that arise out of complex, chaotic phenomena. Schumpeter's perspective is particularly appropriate for the Internet, insofar as the Web is a vast new region that will support a variety of activities, many of which are highly novel in their approach. As an intelligent communication technology, the Internet enables the creation of virtual places, which collectively constitute a vast virtual space that is the creative product of a process of machine-mediated social interaction. Moreover, as Batty (1997) so brilliantly points out, these new cyberplaces are now beginning to reorient the world of physical places.

De Landa emphasizes the points (singularities) at which order begins to arise out of chaos, rendering previously random individual elements into a higher order and a more

powerful whole (mechanic phylum). This process occurs in the natural world, for instance when random air molecules and temperature variations exhibit self-organized coherence to produce a storm. Taken at the individual level, the Internet can be viewed as a collection of individual processes interacting randomly. At this level of analysis one might regard the Internet mainly as a sophisticated communications medium that radically reduces transaction costs between individual nodes (like the telephone). However, if one considers the virtual space of the Internet as a process resulting from the complex interaction of millions of intelligent nodes, it is entirely possible, indeed highly likely, that new processes will emerge from this space itself. However, we regard this emergence, not as a “natural” process, but as one sparked by entrepreneurs, who create new ways of using the Internet or invent new e-commerce business models that are implemented in code (new software).

The apparent simplicity of the Internet belies its power. At first glance the Internet is merely a medium for connections able to transmit anything digitized and a medium allowing for infinite interconnections. Unlike prior communication systems, such as telephony, which established a dedicated connection between two (or sometimes more) nodes, the Internet allows the simultaneous exchange of information in digital form among an unlimited number of nodes, each with its own computing power. The protocols used to transmit data across the Internet are standardized and readable by multiple platforms. Added to this is the innovation of hypertext, that is, the ability to almost effortlessly move from one node to another at a whim -- a feature that is possible because the information has been separated from its physical carrier medium such as paper, celluloid, or plastic. The information content of the Internet is almost completely dephysicalized or dematerialized. It is reduced in its physical essence to the most abstract possible formulation: 1s and 0s carried by laser light or electromagnetic

waves and stored by electrons or magnetic charges. Multi-platform accessible standards, hypertext, and dematerialization have contributed to and are combining with a remarkable increase in the capacity of global telecommunications systems to rapidly reduce the costs of communicating digital data. Furthermore, the reduction-in-cost dynamic itself constantly creates new opportunities. The extreme flexibility of digital representations permits an almost infinite number of activities as diverse as booking airline flights, purchasing items, playing games, viewing pictures, listening to music, or accessing public information. Moreover, once objects, either physical or mental are reduced to digital (i.e., mathematical) representations, they become uniquely malleable and observable, in ways that are not possible with physical or mental objects.

An additional finer power is derived from the fact that the Internet space is a collection of interconnected intelligent machines. Unlike a simple communications device such as a telephone, which is merely a conduit for data, each node connected to the Internet is capable of storing, retrieving, and manipulating data at constantly increasing levels of sophistication. While it is possible to use a telephone to interact with a computer (with touch tone-based menu system, for example), it functions essentially as a dumb machine, merely transmitting pulses entered directly by the user that trigger intelligent functions in the computer located at the other end of the line. At one level the Internet is just another communications system, but at a more important level it is a communications system mediated at all its nodes by powerful computers. Thus, while it is clearly the case that much of the usage of the Internet is predicated on a broadcast model (i.e., information downloaded for user consumption), there will be a cascade of applications that will either utilize the individual user's computer or storage power in some novel and innovative way or draw upon the collective computing

power of the Internet as a whole. In other words, applications will emerge that are not the proverbial economist's network externalities, but are rather network internalities.

Taken together, the intelligent nodes of the Internet (each with its own data and processing power) and their connective links constitute a vast, continuously growing and evolving dataspace.¹ Separated from its material basis, the Internet consists of data of two types: code, that is, the data that instruct the machines how to perform (computer programs), and the data on which the code-instructed machines work (see, for example, Lessig 1999). These data are constantly in motion, directed and utilized by intelligent machines that are directly or indirectly in the service of their biological masters. Far from being an inert mass of digitized information stored on metal or silicon, or a virtual simulation of something else, the Internet dataspace is its own reality, *sui generis*, governed by its own social and technological logic. Thus, the real power of commerce (or anything else) on the Internet derives not merely from the efficiencies of a new communication medium, but from the creative singularities that emerge out of the complex chaos of the Internet dataspace. Put another way, with the interlinked intelligent nodes of the Internet, the sum is greater than the whole of the parts, and even the network externalities.

There can be no doubt that the Internet is transforming the substance of economic activity. This paper aims to explore some aspects of this transformation by speculating upon the meaning of some of the tendencies that are appearing in the economy due to the influence of the Internet. We begin with a brief discussion of the Internet's features, its impact on business, and the difficulties contemporary social sciences have in explaining the Internet and its effects and role in the economy. The next three sections consist of a general examination

of the development and capabilities of the Internet as they relate to commerce, a more focused discussion of the capabilities of the Web for enhancing customer service, and a general examination of the economic and organizational impacts of web-based commerce. This is followed by three sections that examine certain areas in which the commercial application of the Internet is leading to new approaches to doing business, or is having a major impact on the way business is already conducted. These factors underlie the current push for the development of Web "portal" sites, the direct marketing model of personal computer assembly and sales, and the use of the Internet to streamline interfirm transactions through large-scale supplier-producer exchanges. In the final remarks, we raise the question of whether the Internet will lead to the proliferation of numerous niche businesses, or whether certain technological and economic exigencies will lead to domination by a small number of very large content aggregators or product marketers.

The Role of the Internet in the Formation of a New Economic Space

Computers and data communications networks have played a key role in the ongoing transformation of the economy to a form in which materiality becomes subordinate to information and knowledge creation. One way of picturing this change is to understand that in the U.S. during the 1960s through 1980s there was one computer per 10 persons, and in the PC era this figure had changed to ten computers per person. In the late 1990s there were 100 computers per person, and some predict that this ratio will soon be 1,000 computers per person (Khosla 2000). Telecommunications networks already have enormous numbers of computers, working as routers and switches. Even with the telecommunications computers,

¹ It was recently estimated that the Internet dataspace is growing at a rate of nearly two million Web pages per day. A Web page is "a collection of information or Web resources, intended to be rendered simultaneously, and

these numbers seem unbelievable, until one considers that automobiles as well as nearly all consumer appliances now contain a computer of some type. Already, a few of these computers are connected to the Internet; in the next decade, they all will be.

The Internet is a network that connects computers to computers through computers. It is an interactive communications medium through which the user accesses information that would have previously taken much time and physical effort to find.² Because of the nature of computer networks, even the path and information search are logged and therefore converted into information that may be of potential value. Moreover, from an economic standpoint, this entire situation must be seen dynamically because the cost of most of the critical technical components of the system is dropping exponentially in cost; for example, what costs X today will cost half as much in 18 months. The cost of bandwidth is asymptotically approaching zero. What appears expensive today (or nearly impossible to deliver), for example a 3-megabyte data file, will have its cost of delivery halved in 18 months.

With the cost of processing power, bandwidth, and connection continuously declining, it is reasonable to assume that anything that can be digitized will be. In the commercial realm this means that all standardized activities that have a separable information component will likely have that element separated and handled electronically. Even though there is no certainty about the ultimate configuration of Internet-related commerce at maturity, businesses with standardized products such as securities, insurance, music, video, stamps, and tickets will have much of their business conducted on-line. Of course, sales activities can also

identified by a single uniform resource identifier, or URI" (Industry Standard 2000c:176).

² It is interesting to note that the Internet is having another effect, namely the "erasure" of all history prior to the Internet. For example, university students no longer feel a need to go to the library. If it is not on the Internet, it does not exist!

be moved on-line at tremendous savings, because the cost of paper, and the individuals handling it, will be removed from the value chain.

Prior to the Internet, electronic data interchange (EDI) was so costly and time-consuming, and limited in its capabilities that the interactions that between the various parties had to be limited. In other words, one normally interacted with only a small number of potential transaction partners. The Internet rapidly decreased the costs and other entry barrier dramatically increasing the potential market size. For example, in the consumer-to-consumer (C-to-C) area, E-bay has created the world's largest garage sale, and made it continuous (24 hours per day and seven days per week), convenient, and inexpensive. Similarly, in the business-to-business (B-to-B) area, markets are being built (i.e., the code is being written) that can become platforms on which entire industries can trade. Forrester Research estimates that over half of all B-to-B e-commerce will be open marketplace-based trade instead of direct trade between partners (Industry Standard 2000a). Finally, virtual stores, the business-to-consumer (B-to-C) sector, have been created with inventories, i.e., entries in gigantic databases that are dramatically larger than any physical store and are easier to access from any computer. Smart data collection and marketing technologies enable e-store customization all the way down to the individual level, and have precipitated a major debate about the privacy rights of consumers in cyberspace. Ease of access is becoming even greater as the Internet is extended to wireless, enabling a new wave of e-commerce potential.

The increasing dematerialization of communication, i.e., its separation from paper or sound waves, would seem to argue that space no longer matters. But, in fact, the physical dimension of businesses does matter, but in new ways. It is in the transport and warehousing functions that the physical world is manifested. Some dot-coms have embarked on major

building campaigns. For example, in 1999 the Internet grocer Webvan began a \$1 billion project to build 26 warehouses to serve the major U.S. cities. With these warehouses, Webvan hopes to completely reorganize the way groceries and other products are delivered, and move purchasing out of supermarkets and shopping malls by offering a new form of convenience. Another major development is a shift in the mode of product delivery: the use of bulk long-haul trucks to deliver products to traditional stores is giving way to the less-than-load delivery system exemplified by UPS, the U.S. Postal Service, and Federal Express. Since the customer base is now global, these delivery services must also become global. Finally, the Internet has made it possible for these delivery services to offer the customers the ability to track their packages on-line.

The stampede to invest in Internet-related businesses, in the U.S. at a level of nearly \$20 billion in 1999 (an increase of nearly 500 percent over the previous year), has created a situation in which company valuations seem to have departed from all reasonable standards (Industry Standard 2000b). The curious economics of the Internet are exemplified by Yahoo!, which is valued at over \$40 billion, even though it generates a limited amount of income. And yet, it offers a plethora of free services including email, Internet access to a massive Web database, a search engine, stock tracking, file storage, a appointment calendar, chat, a messaging service, travel booking services, news and weather. Like AOL and other Web-user aggregators, Yahoo!'s high market valuation is predicated on the vast future potential represented by its on-line users.

The existence of free content provided by for-profit enterprises goes far beyond simple notions of a loss leader. For example, with the drop in cost of bandwidth, if the current movement towards voice-over-IP continues, the charge for telephone calls globally might just

become a monthly fee. There will be no reason to bill for the minutes themselves. From the perspective of traditional economics, giving products away for free or for a single monthly rate appears foolhardy and even perverse.³ The economics of a product whose cost is asymptotically approaching zero can only be expected to be unusual. Moreover, once landline and wireless telephony follow a more Internet-like pricing model, new value-added services can be marketed over the network. This has caused some economists and business theorists to begin rethinking traditional economic concepts to better account for the value-added from knowledge creation and the “winner-take-all” aspects of capturing or becoming standards in information- and communication-intensive industries (Arthur 1994; David 1986).⁴ The efficiencies and synergies being generated in the electronics and telecommunications realms are driving further analyses and discussion of the New Economy.

Economic puzzles like these are only the tip-of-the-iceberg: other phenomena are pressing beyond the boundaries of traditional social sciences. This is the case where machine-augmented interaction gives rise to new forms of value creation in both an economic and social sense. Website user communities actually are an integral component of the value of many commercial and noncommercial sites. The user community creates value in a profoundly social sense. For example, readers’ reviews are posted at Internet bookseller Amazon.com (Hagel and Armstrong 1997). In this way Amazon becomes more than a mere bookseller leveraging the disintermediative capabilities of the Internet. Users can, and often do, utilize Amazon’s site as a research tool, without buying anything; the site is a sort of

³ Shapiro and Varian (1999) argue this can be integrated into traditional microeconomics. However, their proof is dubious. Many of the concepts discussed in their books are not, in fact, in the traditional canon of neo-classical microeconomics, but rather are business principles. They are not deduced from the principles of microeconomics, which are ultimately based upon the assumptions of perfect information etc.

⁴ The trouble with the economics of software and the Internet is that it begins to break up the entire basic assumptions of neoclassical economics (David 1997, Baetjer 1998).

hyperlinked, constantly evolving, Books in Print and Kirkus Reviews all rolled into one. The social (community) interaction process, and its concomitant communication of information and opinion, and the comprehensive nature of the Amazon site, create its value (Kotha 1998). The significant lesson from both Yahoo! and Amazon is how they provide multiple reasons for the users' continued patronage. Put differently, they enmesh the user.

The Internet and Commerce

By the early 1990s the Internet made available a collection of useful information and downloadable software. However, the tools for accessing this information were complicated and required a certain amount of expertise and system knowledge on the part of the user. Most of the innovations were designed to make the Internet more useful to academics and computer scientists. An important breakthrough came with the World Wide Web (WWW) and Hypertext Mark-up Language (HTML) protocols that were developed by researchers at the European Laboratory for Particle Physics (CERN) in Switzerland to facilitate information exchange among physicists. The next step forward was the development of special software, the browser, which made these and other protocols invisible to the user. Several browsers were developed, some more functional than others, and were distributed freely over the net. One of the early browsers, Mosaic, developed at the National Center for Supercomputing Applications (NCSA) at the University of Illinois Urbana-Champaign became wildly popular: millions of copies downloaded in a few short months after its release. This was perhaps the first instance in which the unique characteristics of the Internet dataspace were leveraged on their own terms, in this case for the purpose of extremely rapid market penetration. Soon, the venture capitalists would develop the term "viral" to describe products or ideas whose

adoption curve could be measured in days and weeks. This confronts business with a treacherous situation in which new competition from a viral application can literally derail a well-planned strategy overnight.

Those firms who wish to succeed in Internet commerce have had to confront and manage four unique characteristics of the Internet: ubiquity, interactivity, speed, and intelligence. The first three features relate to what might be considered the extensive development phase of the Internet. The fourth, intelligence, relates to the capacity for intensive development of the Internet based on its distributed independent processing power.

The first feature is ubiquity. By this we mean that all “places” on the Internet are accessible to the user on what is essentially an unlimited and equal basis. The user can go anywhere on the net with a minimum of effort; there is no inherent technological reason for the user to start at a particular point. Only five years ago, most users had only one entry point to the WWW, either their corporate network or the proprietary network services predating the rise of the WWW in the mid-1990s, such as America OnLine (AOL), Prodigy, and CompuServe. Beginning in the late 1980s, most, if not all, of the benefits provided by these network services were available at either free or subscription stand-alone websites. Now access and availability of content and other services are increasingly available over a variety of media, including telephone lines, television cable, and, soon, wireless.

The second important characteristic of the Internet is interactivity. The Internet itself was developed through a remarkable process of interaction by researchers located around the world. Businesses are changing as they adapt to and take advantage of this feature. For example, commercial publishers who wish to succeed on the Internet must offer more to their customers than what is ordinarily available in print or from some other media. One of the

more successful Web publishers has been the *Wall Street Journal*, which has seen steady growth in its paid subscription base since it connected to fees about two years ago. The Journal's site offers not only standard print content, but also a wide range of information and services not found in the print edition. These include articles from other Dow Jones publications, past article search and retrieval, customized stock quotes, job-finding information, a database of company background information, interactive discussion of various current news topics, a news audio feed, the ability to customize the Web page to the user's interest, and numerous other features. The *Journal* site serves both as a substitute for those with limited access to the print version, such as overseas readers, and as a complement to print subscribers who wish to access additional services such as company and stock tracking from a brand name they know and trust.

The interactive nature of the Internet also gives rise to new forms of collaborative activity. Numerous software producers leverage the communitarian power of the Internet by pre-releasing unfinished "beta" versions of new software products over the Internet, where a large number of interested users can locate problems and offer suggestions for product refinements. This diminishes some of the costly burdens of in-house testing and decreases the distance between software creators and customers by creating an information feedback loop. Moreover, integrating a subset of customers directly into the product development process also accelerates the creation of demand for the finished product. The open source "movement," best exemplified by the Linux operating system and Apache web-server software programs, takes this logic to an even higher level. These programs are downloadable for free, and have relied on the Internet for both their dissemination and their continuing technological evolution. Open source has emerged as an important software

development strategy and has been embraced by numerous startups, and in the case of Linux, even by IBM (DiBona et al. 1999).

The third important characteristic of the commercial Internet is speed (Davis and Meyer 1998; Kenney and Curry 1999b). Because the Internet is an ubiquitous, interactive system based on a multipurpose digital computing platform, changes such as system software upgrades, new standards and protocols, and new publications (content) can be developed and disseminated very rapidly. The availability of out-of-the-box network and network server hardware and easily adaptable software applications, such as credit card billing systems and searchable relational databases, enables the rapid development of commercial systems at very low cost. Moreover, many Internet-based businesses have been developed as overlays on existing infrastructure that further reduce startup costs and time of deployment. The rapidity at which businesses can be established on the Internet means that it is very important to be the first in a particular market category. An interesting case in point is Amazon.com, an Internet bookseller based in Seattle. By relying on existing systems of distribution as a sort of retailing adjunct to them, Amazon was able to start operations quickly and efficiently (Bianco 1997). By purchasing advertising link space for itself on the Internet from frequently visited sites such as Netscape's, Amazon developed a high-volume business in a very short time (Southwick 1996). Founded in 1995, Amazon had over \$116 million in net sales during the second quarter of 1998, an increase of 316 percent over net sales of \$27.9 million for the second quarter of 1997 (Amazon.com 1998). Barnes & Noble, an important innovator of large, high-variety bookstores, has only recently recognized and introduced book selling on the Internet as a logical extension of its own large-scale distribution and inventory-tracking

system (Marcial 1997). But, being a late entrant in the Internet book sales arena, Barnes & Noble is having great difficulty catching Amazon.

The final important characteristic of the Internet is ultimately the most powerful of all. The previous three characteristics correspond roughly to the historical evolution of telecommunications, i.e., the trend of bigger, faster, and better technology. The fourth, intelligence, i.e., the ability, distributed throughout the Internet, to retrieve, store, and process information, renders each node something far more useful than a passive information conduit, and the Internet itself something far more profound than a mere communications system. The machine intelligence (i.e., processor power and code) embedded in each node (both client and server) enables a more intensive mode of development based on the potential of the Internet as a complex, technology-mediated, social relation. Business models and strategies rooted in old notions of marketing that were developed in the era of one-way broadcast media have met with only limited success at best. Those strategies that utilize the Internet on its own terms, as a synergistic whole, understanding in McLuhan's famous words that "the medium is the message" have been more successful.

The individual machine-based intelligence of the Internet has two aspects: node-based and net-based. Node-based intelligence refers to the systems, which, while they are net-oriented, reside primarily in servers and/or clients. This is hardware and code that makes the Internet much more than a mere communications medium, because it extends interaction between individuals to interaction between individuals augmented by intelligent machines, and to ever more sophisticated machine-to-machine interaction. In this classification are all the functions that power the Internet beyond basic communications (such as email): streaming media, user-searchable databases, targeted marketing/advertising, the various tools provided

by portals and other service sites, e-retail functions/sites, and all the other machine-augmented Internet interactivity. The Internet's Net-based intelligence refers to the synergistic development that arises out of the Internet as a whole as a consequence of interactive machine intelligence.

Businesses (and consumers as well) are increasingly able to use their node-based intelligence to both utilize the information creation and storage capabilities of the Internet and create new ways to exploit these capabilities. For example, MicroStrategy builds "data mining" and "decision support" software, which is meant to enable the nascent B-to-B revolution. The term "data mining" is somewhat of a misnomer, in the sense that it may suggest database management software for "data warehouses," i.e., very large databases. MicroStrategy goes beyond this function, as it develops software that enables companies to make use of the Internet to make business decisions about marketing, production, and logistics, based on data "mined" from the Internet. MicroStrategy's applications are not mere stand-alone database applications, that utilize the Internet, but rather applications that allow users to effectively and interactively utilize the vast and constantly growing Internet dataspace. In the same way that the Internet becomes a ubiquitously accessible hypermall, the Internet dataspace becomes a hyperdatabase, requiring users to create metadata, i.e., distilled data such as those generated by search engines or shopping aggregators like C-Net, to effectively utilize it.

There are already numerous examples of other firms that organize, and extract value from the Internet dataspace and undoubtedly there will be many more in the near future. Whispernumbers.com uses automated search technology to sweep the Internet for rumors, opinions, individual estimates, hard data, etc. on company earnings. These data are analyzed

to produce earnings estimates that are generally more accurate than those produced by professional analysts (Gimein 1999). Whispermnumbers.com claims to use its node-based machine intelligence to access the "group mind" of the Internet, leveraging, and going beyond, ubiquity, interactivity, and speed.

Other firms use the distributed computer power of the Internet to develop unique approaches to content distribution and work sharing; in effect, they use the Internet itself as an exploitable resource. Napster is a software program designed to be downloaded to individual users' hard drives, where it creates a file folder in which MP3 files are inserted to make them available to Napster users anywhere in the world.⁵ Unlike one of its counterparts in the MP3 space, MP3.com, which serves MP3 files to its clients on the web, Napster.com does not store any music; it merely matches up the downloader and the provider. Napster transcends the standard client/server logic in which Web-surfing "clients" access the data collected, created, or repackaged by Web "content providers": instead, the program works by making every Napster user a content provider (See Figure 1).⁶

How unusual is the current conjuncture? Napster was created by a 19-year-old college freshman at Northeastern University majoring in computer science (Brown 2000; Rosenberg 2000). There are already improved versions emerging, even while Napster.com is working with universities to improve its current bandwidth-hogging characteristics. But Napster is only the beginning of this lashing together of computers. In late March 2000, a program called Gnutella was developed for file exchange that does not even require central computer

⁵ MP3 is a data compression standard that reduces the bandwidth necessary for the transmission of high quality sound files.

⁶ MP3.com itself demonstrates the communitarian power of the Internet through its creation of a large community of local and regional groups, both amateur and professional, providing them with a very inexpensive way to access a potentially large audience, bypassing the formidable barriers to entry of the current corporate-dominated music industry.

coordination. The introduction of each new use of the Internet seems to ignite yet another round of innovations.

Figure 1 about here

Business-to-Consumer E-commerce

Customer service functions have always been a time-consuming person-to-person activity. However, because most of the interactions are highly routinized, automated systems are a logical choice for reducing the time and cost of such services. An important recent step in automating customer service was telephone call processing, but this was a slow system with very low bandwidth. In other words, an excessively long menu of choices often led to consumer disconnection and difficulties in creating user-friendly branching systems. More sophisticated non-human-intermediated customer service would have to wait until the consumer had a device able to handle greater amounts of information. When the installed base of the PC and the computer modem grew, and the technology was sufficiently mature, it became possible to place information on a server open to customers. This redefined customer service by increasing the level of provision while decreasing the cost. This was possible because most interactions are entirely standard; for example, many customer questions are for routine information such as store hours and directions. Answers to such questions can be codified, indexed, and stored on a server to be accessed on-line and downloaded. For simple questions such as directions, the Internet can be used to download a map, whereas on the telephone error-prone verbal instructions were necessary. Essentially, customers can access

the information they need and create value for themselves from the provider's website at practically no cost, except for the initial startup costs.

In addition to seeking routine information, customers are also attracted to sites that provide detailed information about products or services. A potential customer can browse several competitors' sites, as well as third-party sites that discuss the product in question, to compare prices and features, and gather general information about a particular product or type of product, taking as much time as desired before making a purchase. A study by the Fuqua School of Business at Duke University found that consumers were more likely to buy products from sites that provided comprehensive information than from sites that had slightly lower prices but little in the way of useful information (Bransten 1998). The point is that the user can select the desired amount of information, removing the need for the information provider to make decisions based on an "average" consumer.

The types of customer service provided on-line depend upon the firm's product or service. For example, software companies make available various software patches, add-ons to current products, and/or demos. Increasingly, software programs such as Norton Antivirus or Netscape Communicator have the ability, upon a prompt from the user, to automatically check for updates and then download and install them. Delivery through the Internet is essentially without cost and has the added benefit of developing a connection with the customer. In other cases, service bulletins or product-related data are placed on company websites for informational purposes. These relatively straightforward applications replace or augment previous product upgrading or information dissemination techniques.

Global logistics firms such as DHL, UPS, and Federal Express have taken the potential for customer service much further. Federal Express, one of the aggressive first-

movers, has opened the tracking portion of its computer system to Internet users. Federal Express' initial effort on the Internet was a one-way information provision service that customers could use to receive information about the location of the shipment and its arrival time (Lappin 1996; Grant 1997). The success of this initial effort spurred Federal Express to use the Internet in other ways. Based on its experience with the tracking service, a website was developed to permit customers to use the Internet for all their shipping functions. Customers can schedule pick-ups, and obtain detailed maps of all drop-off locations, rate charts, and other information regarding international customs regulations. Moreover, the site offers free downloadable software that speeds the processing of shipments, allows the user to store addresses in an address book, maintains a shipping history in a log, and creates and prints labels (Fedex.com 1998). Many shipping office functions have been transferred onto software and are operable over the Internet. Human intermediaries and physical documents were replaced by software. Using the Internet to improve customer service is not only less expensive than previous methods, but it also provides the mechanism for creating new methods by which firms and their customers interact. Most critical, the information provided through the server gives the customer the resources to create value from the site.

Organizational Impacts of Web-based Commerce

The potential for e-commerce is illustrated in the highly simplified Figure 2 with its various panels. In Panel 1 we illustrate the conventional system in which products moved from supplier to customer through various intermediaries, while information moved from customer to supplier in the form of paper. The important thing to understand here is that usually product was pushed through the supply chain before the customer had purchased the

product. The information in paper form took a long time to move back to the supplier. Within the system there was the constant threat of waste in the form of products that customers did not want. For example, in the auto industry there was on average 60 days of inventory in the channel from the producer to the customer, and this inventory was tying up capital and losing value. Similarly, the relationship between an assembler and suppliers was driven by information on paper and, unless operated on a just-in-time basis had the same problem of push versus pull.

In Panels 2A and 2B we schematically show how EDI or electronic service industries operated. In Panel 2A paper has been eliminated from the intermediary through to the supplier. However, we should note that the EDI systems were proprietary and quite costly to implement. Moreover, they were usually inflexible and not open to outsiders, due to their high cost and proprietary protocols. In services such as stock trading that could be reduced to electronic impulses, the brokerage houses had already implemented telephone touch pad systems. In other cases, such as travel agencies the customer phoned the travel agent and made requests that travel agent typed into the computer system. In this case the agent had access to the computer, but really was, for simple transactions, merely a data entry operator.

Figure 2 about here

The power of the Internet is exemplified in Panels 3a and 3b. Not only does the Internet connect every node in the value chain, but it also makes possible the addition of entirely new intermediaries. In a value chain that is completely networked, most of the routine paperwork can be removed from the system. Moreover, if it becomes a true pull system, then much risk and inventory can be driven out of the system, making the entire

system more efficient. The ideal example of this is Dell's management of the personal computer value chain (Curry and Kenney 1999).

The Internet provides the potential for entirely new intermediaries, as illustrated in the differences between Panel 1 and Panel 3A in Figure 2. The rise of new intermediaries in the value chain is now actively underway as venture capitalists fund startups intent upon displacing incumbents, creating new marketplaces (or platforms), and reorganizing value chains.⁷ The use of Internet retailing means that a portion of transaction will be transferred from traditional channels to on-line. No previous communications technology has allowed the customer to personally search databases of, for example, books, autos, software, or airline schedules, and then complete the purchase without face-to-face interaction. With Internet browser technology it is possible to remove the service worker as a translator between the analog customer and the digital database, that is, to "disintermediate" the relationship (of course, software is now the intermediary). The ability to have a direct connection between customers and a firm's computers makes it possible to reconceptualize activities that formerly required human service workers. With credit card payment the entire process is electronic, with the exception of delivery. For some goods, such as insurance, stock certificates, and financial instruments, "delivery" consists of an accounting notation in a computer.

There are remarkable benefits for a retailer that can transfer sales activities to the Internet, though they vary by product or service. For the services that have no physical component at all, it may be quite easy to move the entire process on-line. A general benefit is that an Internet retailer can hold far lower inventory levels than a conventional retailer, who must have the items in stock, thereby tying up capital. The difference can be striking. For

example, Amazon.com, the on-line bookseller, turned its inventory over 42 times in 1997, whereas its largest competitor, retail store-based Barnes & Noble, turned over its inventory only 2.1 times (Willis 1998). Moreover, a significant portion of Amazon's inventory is held by distributors who ship the items directly to the customer, although this is changing as Amazon attempts to develop a system of buying directly from publishers (Bianco 1997). Though Amazon began in books, it is expanding to various other items including CDs, videocassettes, and consumer electronics, while investing in an on-line pharmacy and various other Internet retailers. Simultaneously, it began constructing centrally located warehouses to serve its on-line customers.

Internet-based retailing eliminates the costs of retail branches, thereby lowering initial entry costs and the fixed costs associated with retail stores. Moreover, the use of the Internet for sales, combined with the services of delivery firms such as Federal Express and UPS, extends the customer base from the relatively local reach of individual stores to anyone in the world who has access to a PC with a modem and has a credit card. So, not only can the large Wal-Marts enter the Internet market, it is also possible for small local stores anywhere in the world to join the global market by selling their product online. Thus the Internet can disintermediate retailers, but it can also connect them with a much larger customer base.

The ways in which the Internet has changed the economics and organization of the travel industry illustrate the disintermediation of service providers and the growth of a large customer base capable and willing to use the Internet. Complicated sets of purchasing decisions such as booking travel and hotels can be undertaken on-line without the intervention of intermediaries. For example, air travel, car rental, and accommodations can be booked at

⁷ There are some interesting geographical components to this, as many of the new entrants are headquartered in Silicon Valley. The implications of this rise in new intermediaries are a massive shift of economic power from

an on-line travel site. The on-line travel agent can go far beyond a telephonic travel agent by providing much broader and more detailed information including textual descriptions, images, and even reviews of the various destinations. In effect, huge databases of information can be made available to the customer in such a way as to allow users to “customize” their travel agenda. In essence, the customer produces a uniquely customized product from an entirely standardized set of choices.

Compare the economics of an on-line travel agency with that of a conventional agency. At the conventional agency a person interacts directly with the customer, and the time spent with a customer on a booking is a direct cost. In essence, each interaction with the customer is a cost (Department of Commerce 1988: 28).⁸ In addition, travel agents can make costly mistakes; however, on the Internet the customer bears full responsibility for the reservation. In the case of the conventional travel agency, return business depends on building a personal relationship with the customer. The on-line travel agency uses the convenience, price, and brand to encourage repeat business (Hagel and Armstrong 1997).

The travel agent’s experience, combined with a personal relationship with the traveler, can be seen as a knowledge base that enabled them to make recommendations to improve the traveling experience. The travel agent was a form of expert knowledge. Customers not utilizing the travel agent’s knowledge base subsidized those using the knowledge. In an Internet-based system, information on travel habits, previous travel, and other characteristics (i.e., a profile) allows the computer to search its database and match it with similar profiles to be used to offer “self-personalized” services to a customer.

other regions to Silicon Valley.

⁸ Traditionally the travel agent retained 10 percent of the ticket cost. In late 1997 the airlines cut the cost to 8 percent or \$50, whichever was smaller.

The success of on-line travel agencies is apparent (Needle 1998). For example, Microsoft's Expedia site launched in 1996 had more than \$12 million in monthly sales in January 1998 and was growing quickly (Lipton 1998). The U.S. travel industry is being reorganized, not only by new entrants such as Microsoft, but also by the airlines, as they reduce the fees paid to travel agents and encourage customers to buy tickets directly through their websites. For those desiring human contact, the offline travel agent will remain available, but increasingly their services will be paid for directly by the user; witness the increasing use of service charges by the offline travel agencies (a tactic that will accelerate the movement of customers to the on-line agencies).

To recapitulate, the technical capacity for on-line retailing arose via two tendencies that were integrated by the Internet. First, the decreasing cost of long-distance telephony meant that many customer transactions had already been centralized into call-processing centers. Second, the development of sophisticated database management software and the use of corporate Intranets serviced by large-scale computer servers meant that the purchasing process had been largely computerized. The service worker using a networked computer to take an order was merely an intermediary between the customer and the corporate database. On the demand side, the increased usage of email, the development of inexpensive, user-friendly browsers, the widespread use of personal computers with faster modems, and the increase in persons who had access to high-speed local area networks created a large installed base of potential consumers. The final step was to habituate customers to purchase items through cyberspace.

E-malls and Portals

When entrepreneurs began exploring the use of the Internet for e-commerce, the question was how to attract customers. This was a thorny question because the chaotic unplanned topology of the Internet made it difficult for customers to find the vendors (Watson et al. 1998). One experiment was to aggregate commercial websites at an e-mall, which was the analog of the physical world's shopping mall (Economist 1997). The idea was that a website developer would build a website at which a number of vendors would create virtual stores. The aim was for the vendors to pay rent in terms of a fee or a percentage of sales for their site. The developer would be responsible for advertising the site and bringing in the Web surfers. The more creative of these actually generated small buildings that the customer could click on to enter. This business model, built on the suburban shopping mall, seemed entirely plausible. However, the difficulties became obvious rather quickly. The shopping mall provides a centralized place for consumers who had moved away from traditional downtown shopping districts to the suburbs. Prior to the automobile, the downtown had been served by public transit such as streetcars and subways, so commerce clustered at its nodes. The fatal flaw with e-malls was that there were no reasons such as convenience, less traffic, or lack of crime that would impel "shoppers" to visit the mall rather than go "downtown." Moreover, the cost barriers to starting an e-store were never high enough for merchants to "locate" in an e-mall rather than build their own site. Though recently, the portals and very successful sites such as Amazon have been able to attract merchants to their sites.

Another problem related to the relatively slow acceptance of the e-mall idea is advertising. Many commercially oriented sites rely on advertising as either a full or partial source of revenue. The proprietary on-line services such as Prodigy, MSN, or AOL serve as

excellent advertising vehicles since their users are forced to start with their proprietary interfaces. The rise of the ubiquitous Web, however, has challenged the proprietary on-line service models since users with "direct" Internet connections can essentially start wherever they want. This presents a problem for those companies who seek revenue from advertising and/or linking partnerships with on-line vendors. Like any other medium, the more viewers you attract, the more you can charge for advertising. Thus, with the viewer free to roam, the focus shifts from getting people on-line to getting people who are on-line to go to your site. AOL has been particularly successful with users who can, if they wish, access the Internet directly, but who feel more comfortable using AOL's proprietary interface as their "home base" on the Internet. Part of the reason for this is that AOL has been very successful in creating a sense of community for its members, something which it emphasizes in its advertising and has worked very hard to build through its early integration and promotion of technologies such as Internet Relay Chat (IRC) and instant messaging.

In addition to individual specialized sites such as Amazon.com for books, CDNow for CDs, and Auto-by-tel for automobiles, portals were also able to capture the general traffic. The portals began by attracting Web users by offering search and classification services to their users. As mentioned previously, they evolved by adding numerous other utilities and resources accessible for free by Internet users. However, because of the number of individuals that utilize these services, they have an enormous audience, which means that space on the portal was very valuable. Advertising on the portals had an additional benefit of offering an immediate "click-through" to the vendor. This immediate connection meant that the customers delivered were actually searching for a product.

The portals have become the one-stop shop for all the Internet needs of consumers (Rindova and Kotha 2000). Their strategy has been to integrate the consumer into their site, thereby giving the portal an ability to deliver a habituated base of consumers to retailers and advertisers. This has led them to constantly evolve by offering more services and options, from free email to free Internet access and beyond. The more a user utilizes these services, the less likely he will move to another site due to the costs involved in becoming familiar with a new interface and reentering data. It also adds ubiquity to the client side by enabling users to access their customized services, such as email or an appointment calendar, from any computer. With the decreasing cost of bandwidth and storage capacity, it is not entirely unlikely that most consumer computing, including word-processing, spreadsheets etc., will be done through a portal. Already several startups such as Desktop.com, MyInternetDesktop.com, Launchpad.com, and iDrive, have begun to offer services such as file storage and backup and virtual desktops with everything from schedulers to purchase requisitions. The moves in this direction actualize the Sun Microsystems phrase, "the network is the computer," in new and powerful ways and will likely spark yet another new wave of innovations.

The e-mall failed because it was not a destination for anything but retailing, so it could not create synergies and, in effect, capture the Web surfers' time. Portals have evolved away from the limitations of the client/server concept and towards finding ways to leverage the potential singularities of the Internet dataspace. The portals started out as Web catalogues and search engines, then sought to gain audience mindshare as content aggregators and distributors, eventually reaching the current period where they are becoming useful adjuncts to users' daily life in cyberspace. For many users, portals are Net-centric PC applications as

indispensable as word processors and spreadsheets. From a commercial perspective, portals are in a unique position because they are central nodes in the Internet world.

Business-to-Business E-commerce

It is curious how a century changes our perspective. In the 1890s Max Weber celebrated the rationality of a bureaucracy that kept track of everything on paper, and certainly large-scale enterprise would have been impossible without such bureaucracies, but entire layers of workers did little but collect and transmit information in a relatively mechanical fashion. Their jobs were not to give meaning to the information, but merely to collate and transmit it.⁹ The strength of this system was that it provided information necessary to make decisions; the weakness was that it demanded lengthy decision cycles.

The world of B-to-B commerce has traditionally been paper-intensive, and was usually a highly routinized process with no economies of scale. The actual process of exchanging paper for procurement creates no value, it is simply a method of keeping track of things. The entire process of procurement created inefficiencies for both the buyer and seller. The ability to move this activity on-line already existed before the Internet, but the establishment of one easy-to-use protocol meant that it became much simpler to move procurement on-line. The initial efficiencies are obvious and massive, including moving the human beings out of the mechanical segments of the information interchange pipeline, thereby increasing reliability and speed. But this is only the initial advantage; when it is completed, every step in the procurement process can be monitored and optimized. In

⁹ We do not underestimate the sometimes complicated task of preparing information, which clearly has non-mechanical components inherent in the activity.

addition, companies can collect data about the data stream, allowing still more opportunities for optimization.

The discussions of the impacts of the Internet have focused on disintermediation/reintermediation, which while correct, does not fully capture the significance of the Internet as a medium for the relationship between firms (Kenney and Curry 1999a). One consulting firm, the Yankee Group (1999), in one of the more conservative estimates, predicts that B-to-B electronic commerce in the United States will increase at a compound annual growth rate of 41% over the next five years, from \$138 billion in 1999 to more than \$541 billion in 2003. There are two levels of B-to-B e-commerce that we examine: The first level is the creation of websites at which purchasing can occur. This can be as simple as the site Cisco developed for its customers, which already has over \$10 billion a year in sales. However, of more interest that this automation of the mechanical aspects of the sales function are the various auction and exchange sites that represent new platforms upon which business can be conducted. The second level to be discussed is the building of software machinery for automating the entire purchasing function, i.e., the relationship between a buyer and a seller.

The creation of any marketplace has an implicit power dimension; it is not simply a technical question. In the B-to-B arena this is particularly true, because the owner of the transaction platform has the potential to control the transaction conducted, both in terms of rules, but also in terms of rents (Bar and Murase 1998). The simplest B-to-B arrangement is for a firm such as Intel to establish a site, to which its customers go to order parts according to some established price list. This is no different from the B-to-C businesses. Intel's power and the highly oligopolized market make this a viable strategy, but few other industries have such a dominant vendor with such a standardized product. For most industries a platform,

which creates a market, is highly desirable from an efficiency perspective, because information can be exchanged in real time with no time-consuming, costly paper flows. In disaggregated markets it can bring more buyers and sellers together, ensuring greater efficiency. Often commercial firms have excess stock of various commodities, and because the market is so disaggregated, such firms sell the commodity at a near-total loss to an odd lot handler, who then searches for a customer. If a market platform for such odd lots can be created, then customers and purchasers can be matched without resort to such intermediaries.

The governance of a B-to-B market is very important, and there are pitfalls that discourage entry. There is a path dependency issue, because once an exchange becomes dominant, the large cost of switching would discourage the participants from exiting. This makes all of the participants vulnerable to hold-up, despite the fact that their participation in the exchange is what gives it value. Thus the decision to join such a market is fraught with risk. For the promoter of the platform, the issue is to attract desirable or lead customers and/or suppliers, depending upon where the power lies. If these leaders announce that they will only conduct purchases on a particular platform, then a market tipping might occur, making the site the platform for nearly all exchanges in that industry or industrial sector.

In the last three years, websites seeking to aggregate B-to-B commerce have proliferated. One venture-capital funded startup, VerticalNet.com, has established approximately 75 vertical markets in nine major groups such as food and packaging. To illustrate, under the "food and packaging" heading the markets are bakeries, beverages, dairy, food, food ingredients, meat and poultry, and packaging. Each market has not only a transaction platform, but also an on-line trade magazine. The executive responsible for the market is an "editor." Another startup, GoCargo.com, allows real-time pricing for cargo

container space. Before the Internet, the market for cargo space was extremely disaggregated and worked primarily via the friendship ties between purchasers and suppliers. The system was costly because of the intensive human interaction, but the main source of inefficiency was the high cost of searching for cargo space. Much of the human interaction was simple information transfer, and computers can now take over this role. The real value humans added was in the case of nonstandard transactions or unexpected events, i.e., times in which the system went "nonlinear." In this example, and in other cases of B-to-B e-commerce, the creation of transparency and more perfect information flow can result in important new efficiencies. E-commerce removes the costs of producing and transferring paper --an important gain in itself. But, most important, when economic activities become transparent, they can be manipulated or tweaked to improve them.

The politics and power dimensions of these exchanges are becoming apparent as big buyers and sellers begin to create their own exchanges. In early 2000, General Motors, Ford and Daimler/Chrysler announced their intention to create a unified exchange where they plan to process about \$240 billion in annual purchasing. It is predicted that purchase-order processing fees should be reduced from \$100 to \$10. Initially, all three companies had planned to build separate sites, which would have created duplication and made the situation difficult for suppliers who would have to operate under three separate billing systems. The Big Three automakers want their suppliers to use this site for purchasing from their own second-tier suppliers. The suppliers will be expected to pay a transaction fee for the use of the site. The launching of this site will dramatically reduce the potential for independent sites to be established. In addition, the automakers' control of the site and access to the information about supplier behavior, and even the costs of suppliers' inputs, will increase the

power of the Big Three. The exchange will likely create efficiencies for the value chain as a whole even while it increases the power of the assemblers (Dalton 2000).

This move by the Big Three is not unusual. Big firms across a number of competitive, but oligopolized, sectors are considering whether they should allow the VerticalNet-type startups capture the benefits of such exchanges. Increasingly, they are concluding, as did the Big Three, that it might be better to establish their own independent exchanges in which they hold an equity interest, and they can capture the benefits of electronic intermediation through their own sponsored startup. The number of large-firm-driven B-to-B startups is rapidly increasing, and they may be able to outmaneuver the startups. The outcome is still uncertain.

Discussion

The Internet is more than just another communications device. It is a newly developed space with the power to give rise to novel forms of human social interaction in almost any area of human endeavor, commercial or otherwise. By enabling activities, such as music sharing with Napster, the creation of online B-to-B market places, and online community building, the Internet will impact consumer behavior, firm behavior, and industrial organization. The full extent of the economic changes caused by the Internet are difficult to predict with certainty, because the features of the Internet interact in problematic and contradictory ways. Perhaps the most challenging questions are related to the Internet's potential economic impacts on market niches and firm formation. Will the Internet encourage the development of a vast collection of business types, marketing strategies, and market niches? Or will it lead to a small collection of mega-marketers (such as the portals and Amazon), each dominating a particular product or service, and making the Internet seem like

the proprietary on-line services it replaces? There are arguments to be made in favor of both possibilities.

At one level, the Internet can be conceptualized as a giant machine for reducing transaction costs. As we have seen, the Internet is being used in a myriad of ways to speed and enhance relations between consumers and firms. The Internet reduces physical and bureaucratic drag by drastically reducing the importance of location and the number of procedural steps that require the direct intervention of firm operatives. For example, on the retail side, the external costs associated with opening, maintaining, and staffing actual physical stores are reduced; and on the production/distribution side, the time-related costs of generating and circulating paper are reduced. Startup costs are also greatly reduced, in that all anyone really needs to begin selling things over the Internet is a connected server, or space on someone else's server. This has led to a proliferation of individuals and firms attempting to use the Web for commercial purposes.

The power of the Internet, however, cannot be comprehended merely in terms of efficiency. As long as the Internet remains an essentially open platform, its ability to develop novel opportunities and novel approaches will likely remain high. It is possible that the simple dichotomy between big and small is problematic in cyberspace. Indeed, perhaps the biggest error made by those companies who “don’t get” the Internet is the assumption that it is nothing more than giant transaction cost reducer, or in Bill Gates’ terms, a tool for friction-free capitalism. The most successful enterprises of the future will be based on the Internet’s own paradigm, rather than paradigms borrowed from the past. Large-scale Web enterprises that seem such inevitable successes today, could, in a few years time, be hopelessly mired in their assumptions, and rendered meaningless by the collective imagination and creativity of

cyber innovators who are only beginning to learn the true contours of the new world they are creating.

REFERENCES

Websites mentioned in article

Altavista: www.altavista.com
Amazon: www.amazon.com
AOL: www.aol.com
Auto-By-Tel: www.autobytel.com
Barnes & Noble: www.bn.com
CDNow: www.cdnw.com
Cisco Systems: www.cisco.com
CompuServe: www.compuserve.com
Desktop.com: www.desktop.com
Federal Express: www.fedex.com
GoCargo.com: www.gocargo.com
Idrive: www.idrive.com
Launchpad.com: www.launchpad.com
Microsoft Expedia: www.expedia.com
Microsoft Network: www.msn.com
MP3.com: www.mp3.com
MyDesktop.com: www.mydesktop.com
MyInternetDesktop.com: www.myinternetdesktop.com
Napster: www.napster.com
Prodigy: www.prodigy.com
Seti at Home: setiathome.berkeley.edu
VerticalNet.com: www.verticalnet.com
Wall Street Journal, Interactive Edition: www.wsj.com
Webvan: www.webvan.com
WhisperNumbers.com: www.whispernumbers.com
Yahoo!: www.yahoo.com

Books and Articles

Amazon.com. (1998) "Amazon.com Acquires Three Leading Internet Companies," (August 13) (<http://www.amazon.com>).

Arthur, W. Brian (1994) Increasing Returns and Path Dependence in the Economy. Ann Arbor: University of Michigan Press.

Baetjer, Howard Jr. (1998) Software as Capital: An Economic Perspective on Software Engineering. Los Alamitos, CA: IEEE Computer Society.

Bar, Francois and Emily Murase (1998) "Charting Cyberspace: A U.S.-European-Japanese Blueprint for Electronic Commerce," Transatlantic Trade Cooperation in Asia: Sectors, Issues, and Modalities. Washington, DC: Council on Foreign Relations.

- Batty, Michael (1997) "Virtual Geography," *Futures*, 29 (4/5), 337-352.
- Bianco, Anthony (1997) "Virtual Bookstores Start to Get Real," *Business Week On-line*, October 27, <http://www.businessweek.com>.
- Bransten, Lisa, (1998) "There's More to E-Commerce Than Just the Lowest Prices," *Wall Street Journal Interactive Edition* <http://interactive.wsj.com>.
- Brown, Janelle (2000) "MP3 Free-for-all," <http://www.salon.com/tech/feature/2000/02/03/napster/index.html>
- Curry, James and Martin Kenney (1999) "Beating the Clock: Corporate Responses to Rapid Change in the PC Industry," *California Management Review*.
- Dalton, Greg (2000) "The Suppliers' Demands," *Industry Standard*, March 13, 59.
- David, Paul (1986) "Understanding the Economics of QWERTY: The Necessity of History," In: W. Parker (ed.), *Economic History and the Modern Economist*. New York: Basil Blackwell.
- David, Paul. (1997) "Path Dependence and the Quest for Historical Economics: One More Chorus of the Ballad of QWERTY." Unpublished manuscript (November).
- Davis, Stan and Christopher Meyer (1998) *Blur: The Speed of Change in the Connected Economy*, Reading, Mass: Addison-Wesley.
- Department of Commerce (1998) *The Emerging Digital Economy*, Washington, DC: U.S. Department of Commerce.
- De Landa, Manuel (1991) *War in the Age of Intelligent Machines*. New York: Zone Books.
- DiBona, Chris, Sam Ockman, and Mark Stone (1999) *Open Sources: Voices from the Open Source Revolution*. Sebastopol, CA: O'Reilly.
- Economist, (1997) "In Search of the Perfect Market," November, <http://www.economist.com/editorial/freeforall/14-09-97/ec1.html>.
- Federal Express, (1998) June 6, <http://www.fedex.com/us/>.
- Gimein, Mark, (1999) "The Information Laundromat," October 26, http://www.salon.com/tech/feature/1999/10/26/whisper_numbers/index.html.
- Grant, Linda (1997) "Why FedEx Is Flying High," *Fortune*, November 10.

Hagel, John and Arthur Armstrong (1997) Net Gain: Expanding Markets through Virtual Communities. Boston: Harvard Business School Press.

Industry Standard (2000a) "Behind the Numbers: The Mystery of B-to-B Forecasts Revealed," Industry Standard, February 28, 158-61.

Industry Standard (2000b) "Financial Spotlight: Inside the Dot-Com VC Billions," Industry Standard, February 28, 163-64.

Kenney, Martin and James Curry (1999a) "Knowledge Creation and Temporality in the Information Economy." In: Raghu Garud and Joe Porac (eds.), Cognition, Knowledge, and Organizations. Connecticut: JAI Press, 149-170.

Kenney, Martin and James Curry (1999b) "E-Commerce: Implications for Firm Strategy and Industry Configuration," Industry and Innovation, 6 (2), 131-151.

Khosla, Vinod (2000) "The Terabit Tsunami," March 7,
<http://www.kpcb.com/team/vinod.html>

Kotha, Suresh. 1998. "Competing on the Internet: The Case of Amazon.com."
http://www.netesteem.com/Studies/studies_amazon.htm

Lappin, Todd, (1996) "The Airline of the Internet," Wired, December, 234-241.

Lessig, Lawrence (1999) Code, and Other Laws of Cyberspace. New York: Basic Books.

Lipton, Beth (1998) "New Territory for Net Travel," CNET NEWS.COM, April 3.

Marcial, Gene G (1997) "A New Chapter for Barnes & Noble?," Business Week On-line, October 13, <http://www.businessweek.com>.

Needle, David (1998) "Traveling the Information Highway," Upside, May, 88-92, 154-160.

Rindova, Violina and Suresh Kotha (2000) "The Dynamics of Form and Function: How Yahoo! and Excite Pursue Competitive Advantage,"
http://www.netesteem.com/downloads/Research%20Papers/yahoo_pap.pdf.

Rosenberg, Scott (2000) "The Napster files," Salon, February 4,
http://www.salon.com/tech/col/rose/2000/02/04/napster_swap/index.html

Schumpeter, Joseph (abridged by Reindig Fels) (1969) Business Cycles. New York: McGraw Hill Inc..

Shapiro, Carl and Hal Varian (1999) Information Rules. Cambridge: Harvard Business School Press.

Southwick, Karen (1996) "Interview with Jeff Bezos, Amazon.com," Upside, October, 29-34.

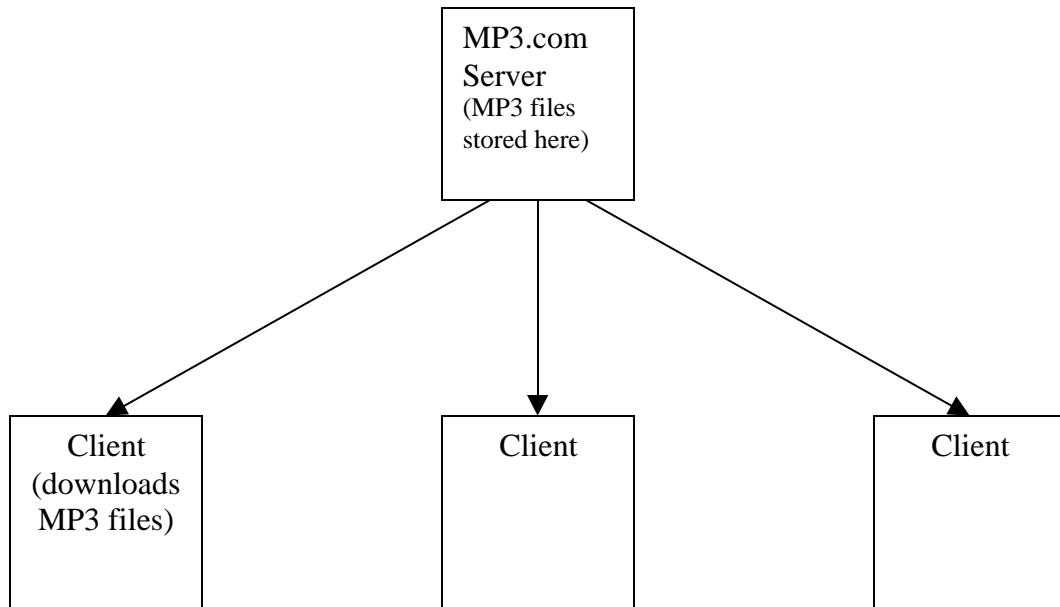
Watson, Richard, Sigmund Akselsen, and Leyland Pitt (1998) "Attractors: Building Mountains in the Flat Landscape of the World Wide Web," *California Management Review*, 40 (2), 36-56.

Willis, Clint (1998) "Does Amazon.com Really Matter?" *Forbes ASAP*, April 6.

Yankee Group (1999) "Business-to-Business E-Commerce," March 9.

Figure 1. The MP3.com (Client-Server) Model Versus Napster (Dataspace) Model

MP3.com:



Napster:

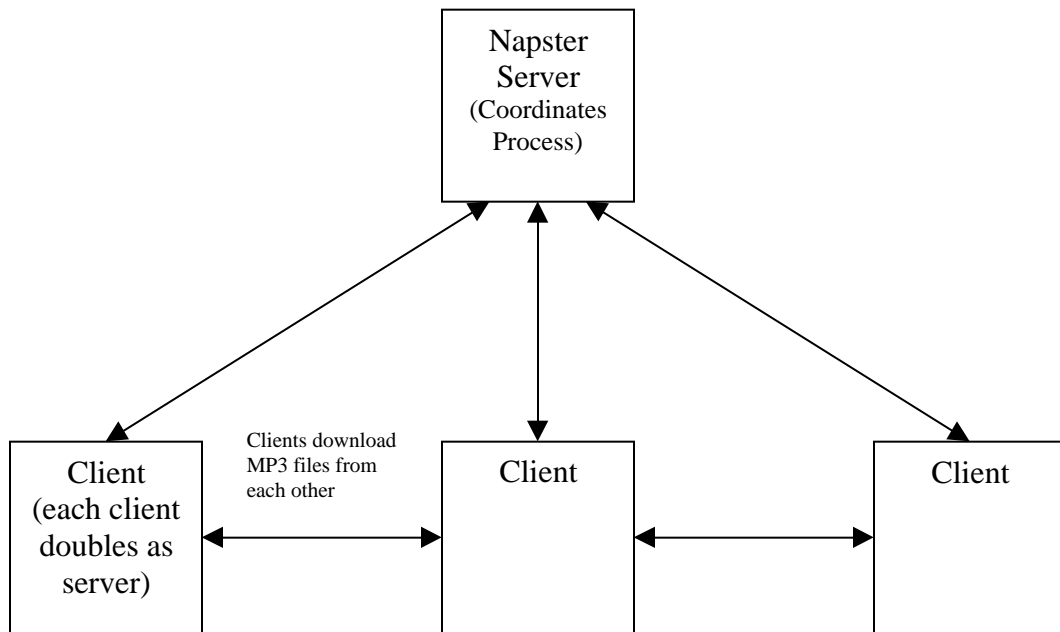


Figure 2. Evolution of Value Chains into Internet Era

