Where Value Lives in a Networked World

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Feeling baffled by the seemingly endless upheavals of the digital age? You’re not alone. But by learning to recognize two simple patterns in the evolution of networks, you may be able to turn chaos into opportunity.

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In recent years, it seems as though the only constant in business has been upheaval. Changes have occurred at every level, from the way entire industries are structured, to the way companies interact with customers, to the way basic tasks are carried out in individual organizations. In response, many managers and management thinkers have thrown up their hands, proclaiming an era of radical uncertainty. Business has become so complex, they say, that trying to predict what lies ahead is futile. Plotting strategy is a fool’s game. The best you can do is become as flexible as possible and hope you’ll be able to ride out the waves of disruption.
There’s some truth in that view. The business world has become much more complicated, and the ability to adapt and respond is now as important as the ability to anticipate and act. But we take issue with the assumption that the changes we’ve been seeing are random, disconnected events and thus unpredictable. We have studied the myriad upheavals taking place in business, and we’ve concluded that many of them have a common root, which lies in the nature of intelligence in networks. Put simply, the digitization of information, combined with advances in computing and communications, has fundamentally changed how all networks operate, human as well as technological, and that change is having profound consequences for the way work is done and value is created throughout the economy. Network intelligence is the Rosetta Stone that can enable executives and entrepreneurs to decipher many of the phenomena shaping the future of business.

The evolution in network intelligence may sound like an awfully abstract topic, but it has immediate and very concrete implications. The future of many technology companies, from Dell to AT&T to hordes of Internet start-ups, hinges on their ability to recognize and adapt to shifts in network intelligence. And even if your company is not directly involved in the communications or computing business, it will not be immune to the impact of shifts in network intelligence. In a highly connected world, the location and mobility of network intelligence directly influences the way companies organize their people, market products, manage information, and work with partners. “The network is the computer,” Sun Microsystems has famously proclaimed. We would go even further: the network is the economy.

### Intelligence in the Network

Let’s start with some basic definitions. A network is a conduit for information; it can be as simple as two tin cans tied together with a string or as complicated as the Internet. The intelligence of a network is its functionality—its ability to distribute, store, assemble, or modify information. A simple analog network, like the two tin cans, is considered “dumb”; it’s just a pipe that transports information without enhancing it. A complex digital network, like the Internet, is “smart”; it can improve the utility of information in multiple ways. That’s crucially important for one simple reason: in an information economy, improving the utility of information is synonymous with creating economic value. Where intelligence resides, so too does value.

As networking technologies have advanced in recent years, both the location and the mobility of network intelligence have changed dramatically. (See the exhibit “The Two Patterns in Intelligence Migration.”) By understanding the patterns underlying those changes, you can gain valuable insight into the way economic value is shift-

### The Two Patterns in Intelligence Migration

As network technologies have advanced in recent years, both the location and the mobility of network intelligence have changed dramatically. As for location, back-end intelligence becomes embedded in a shared infrastructure at the network’s core, while front-end intelligence fragments into many different forms at the network’s periphery, where the users are. As for mobility, large units of intelligence that were once disconnected become small units of free-floating intelligence that coalesce into temporary bundles whenever and wherever necessary to solve problems.
Value Trends in the Network Age

In a networked world, where everyone and everything is connected, economic value behaves very differently than it does in the traditional, bounded world. Here are four high-level value trends that all companies should be conscious of as they position themselves in the digital economy.

Value at the Ends. Most economic value will be created at the ends of networks. At the core—the end most distant from users—generic, scale-intensive functions will consolidate. At the periphery—the end closest to users—highly customized connections with customers will be made. This trend pertains not only to technological networks like the Internet but to networks of companies engaged in shared tasks and even to the human networks that exist within companies.

Value in Common Infrastructure. Elements of infrastructure that were once distributed among different machines, organizational units, and companies will be brought together and operated as utilities. Shared infrastructure will take the form not only of basic computing and data-storage functions but also of common business functions, such as order processing, warehousing and distribution, and even manufacturing and customer service.

Value in Modularity. Devices, software, organizational capabilities, and business processes will increasingly be restructured as well-defined, self-contained modules that can be quickly and seamlessly connected with other modules. Value will lie in creating modules that can be plugged in to as many different value chains as possible. Companies and individuals will want to distribute their capabilities as broadly as possible rather than protect them as proprietary assets.

Value in Orchestration. As modularization takes hold, the ability to coordinate among the modules will become the most valuable business skill. Much of the competition in the business world will center on gaining and maintaining the orchestration role for a value chain or an industry.

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The Mobilization of Intelligence. In a connected world, intelligence becomes fluid and modular. Small units of intelligence float freely like molecules in the ether, coalescing into temporary bundles whenever and wherever necessary to solve problems. Consider SETI@home, a project launched by the University of California at Berkeley to search for extraterrestrial life. Radio signals received by the world’s biggest telescope dish—the 1,000-foot Arecibo Observatory in Puerto Rico—are carved into 330-kilobyte “work units” and distributed over the Internet to PCs around the world. Individual computer owners donate their spare computing cycles—their processing intelligence—to the project by allowing their computers to analyze data in the background or when idle. Within a year of its launch in May 1999, more than 2 million people in 226 countries had provided about 280,000 years of computer time to the effort. SETI@home has a total computing power of roughly 12 teraflops, making it four times as powerful as the world’s fastest supercomputer. The network makes it possible to pool the intelligence residing in millions of computers across the globe into an ad hoc system with massive computing capability.

The mobilization of intelligence has profound organizational implications. Connected by networks, different companies can easily combine their capabilities and resources into temporary and flexible alliances to capitalize on particular market opportunities. As these “plug-and-play” enterprises become common, value shifts from entities that own intelligence to those that orchestrate the flow and combination of intelligence. In other words, more money can be made in managing interactions than in performing actions. That explains why companies like Cisco and Hewlett-Packard are evolving into intelligent hubs that coordinate the interactions among a network of channel partners, suppliers, and customers. By connecting the business processes of manufacturing service providers like Solectron and Flextronics to the business processes of channel partners and customers, Cisco and HP are able to coordinate the intelligent flow of information in their business networks. As a consequence, they are able to extract the bulk of the value created by the network, much as the conductor of a symphony orchestra garners the lion’s share of the audience’s applause.

Just as the decoupling of intelligence requires a reliable high-speed network, the mobilization of intelligence requires a common language. Without the existence of universal protocols for information exchange, individual pieces of intelligence cannot communicate and collaborate. For instance, the mobilization of intelligence among devices requires device-to-device communication protocols like Bluetooth and Jini. The mobilization of intelligence from the Internet to wireless devices requires protocols like the Wireless Applications Protocol (WAP). And the organization of plug-and-play business networks requires the widespread adoption of protocols for describing products and processes like Extensible Markup Language (XML). The development of these and other network standards will play a large role in determining the future shape of business.

Reshaping Industries

The decoupling and mobilization of intelligence are changing the competitive landscapes of many large industries. The most dramatic effects, not surprisingly, are being felt in network-based businesses like telecommunications. When traditional telephone companies built their analog systems, they had to bundle many different kinds of intelligence—for processing, transport, and user functionality—into the middle of their networks. The wires needed to be smart because the user device was dumb—a simple rotary phone. But the emergence of digital networks based on the Internet Protocol (IP) has turned the old networks into huge, expensive albatrosses around the phone companies’ necks. Because intelligence can now be embedded in servers, software, and intelligent devices located at the core as well as at the periphery of the network, the middle of the network can and should be dumb. All that’s needed is a fast and reliable pipe, with a little bit of routing intelligence.

This shift poses a grave threat to service providers like AT&T, which rely on voice and data transport for the bulk of their revenues. As transport becomes a commodity, rates for long-distance telephony are plummeting. Start-ups like Dialpad and Go2Call are even offering free PC-to-phone long-distance service over the Internet. The real value in telecommunications is shifting to the ends of the network. At the core, infrastructure providers like Sun, Cisco, Nortel, and Lucent are earning big profits. And at the periphery, companies like Yahoo!, InfoSpace, America Online, and Phone.com are extracting value by controlling the user interface and managing customer relationships. Even in the emerging broadband and wireless arenas, service providers will find it difficult to make money just by selling access to the Internet. They will have to provide value-added infrastructure services—like hosting, systems integration, and network maintenance—or find a way to earn commissions on the transactions that flow through their pipes.

The computing business is going through a similar transformation. The functionality that was once built into computers or sold as software packages can now be delivered over the Internet, much as utility companies deliver electricity through power lines. Just as corporations and consumers no longer need to own their own generators,
Network Intelligence in the Public Sector

The migration of network intelligence affects more than business. It also affects public sector activities, such as government, national security, and education. Governments, for example, will be challenged to use electronic networks in general and the Internet in particular to deliver information and services to citizens in much more diverse and personalized ways. The monolithic government bureaucracy will shatter, and new forms of distributed government will emerge. Interestingly, some of the most creative governmental applications of the Internet are found in developing nations. One example is the Indian state of Andhra Pradesh, with a population of 70 million. Under the leadership of its cybersavvy chief minister N. Chandrababu Naidu, it is rolling out an “e-government” system that will let citizens pay taxes and fees, apply for licenses and permits, and participate in municipal meetings through their home computers or public Internet kiosks.

The defense establishment will also need to radically reshape itself to adapt to the digital world, where threats to national security tend to be distributed among far-flung terrorist activity “modules” rather than centralized in powerful states. Centralized intelligence will need to be decentralized and dispersed. (Perhaps the CIA will be replaced by the DIA – the Distributed Intelligence Agency.) And the military will need to be reorganized to emphasize relatively small autonomous units at the edges connected through a network to a central core of coordination and command.

Some of the most radical changes will take place in education. Students will no longer need to come together in centralized institutions to take general courses. Using the intelligence of the Internet, they will be able to remotely access modules of education and training content, assembling courses of instruction that respond to their immediate and particular needs. Universities will need to shift from providing generalized just-in-case knowledge to providing customizable just-in-time knowledge.

they’ll soon be freed from having to own their own computing hardware and applications. Already, consumers can use Yahoo!’s servers to store their e-mail messages, calendars, address books, digital photographs, digital wallets, faxes, and data files. And businesses can now purchase, on an as-needed basis, the computer applications required for customer service, human resource management, accounting, and payroll from outside service providers.

Obviously, this trend has profound implications for traditional hardware and software companies. To go where the value is, they’ll have to transform themselves from product companies to service providers, or they’ll have to shift their focus from selling primarily to end users to selling to the big infrastructure providers like Yahoo! and Exodus. Dell Computer, in a major effort to reinvent itself, is taking both paths. In February 2000, Dell announced a series of initiatives called “Dell E Works” aimed at broadening its revenue base beyond traditional hardware. It now offers its enterprise systems and storage products over the Internet through its Dell Hosting Service, and it is expanding into services like e-consulting and Web hosting. It is also enlarging its customer base to include Internet service providers (ISPs) and hosting companies that provide computing as a utility. As part of this effort, it is moving beyond its reliance on the Windows operating system by embracing Linux, an OS better suited to running the robust servers owned by the computing utilities. The new initiatives are already paying off. In the quarter that ended July 28, 2000, Dell’s “beyond the box” revenues increased 40% from the previous year, accounting for 16% of the company’s net revenues.

Reshaping Companies

The impact of intelligence migration is being felt within companies as well as across industries. The shrinking of middle management in many organizations, for example, is another manifestation of the hollowing of the middle, as intelligence gets pushed to the core (in this case, top management) and the periphery (frontline employees). Before robust digital networks and easy-to-use collaboration tools like e-mail, groupware, and intranets existed, it was difficult to communicate information through a large organization. So a lot of middle managers were needed to package and distribute information between top management and frontline employees. But now that people are connected electronically, information and intelligence can be transported more seamlessly. As a result, the information-transport function of middle managers has become superfluous. Just as the telecom network can have dumb pipes with intelligent ends, the organization can have a dumb information network that allows senior managers to communicate directly with frontline employees. Leadership and strategy get centralized at the top management level, while the ability to act and make decisions is pushed to the periphery of the organization. The challenge for the remaining middle managers is to redefine their roles as coordinators, facilitators, organizers, and mentors – to provide new kinds of organizational intelligence.
The mobilization of intelligence is having other organizational effects as well. Rather than being centralized in discrete units, a company’s capabilities are becoming more distributed and more modular. The Internet lets geographically dispersed individuals and teams connect to solve customer problems or respond quickly to market opportunities. A company can, for example, locate its

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R&D capabilities in Silicon Valley, its engineering capabilities in India, its manufacturing capabilities in China, and its customer-support capabilities in Ireland. The interaction of the far-flung units is mediated, moment by moment, by the network, not by a large, expensive, and slow-moving managerial staff. In fact, it may now make more sense to talk about a company’s “distributed capabilities” instead of its “core capabilities.” (See the sidebar “Network Intelligence in the Public Sector.”)

The same kind of flexible collaboration is also changing business-to-business interactions. We see it in the sharing of Internet-based business infrastructures. Direct competitors are, for example, coming together to share supply chain platforms by forming consortia like Covisint (in the automobile industry), Envera (in the chemicals industry), and Transora (in the packaged-goods industry). We see it as well in the packaging of corporate capabilities, such as FedEx’s order tracking functionality and General Electric’s consumable supplies ordering, as modules that other companies can purchase and plug in to their own operations. More profoundly, the ability to creatively combine capabilities distributed among many different companies is enabling complex virtual enterprises to be formed on the fly. A whole new class of software, created by companies like Bowstreet, G5 Technologies, and Hewlett-Packard, is emerging that will form the glue for such plug-and-play organizations. By coding business processes in common protocols, such as XML, this software enables different companies’ processes to be easily connected or disconnected to suit their business needs.

Companies that really understand how intelligence migration is reshaping business are often able to better exploit the power of the Internet. Avon is a good case in point. Its first response to the Internet back in 1997 was to launch a site for selling cosmetics directly to customers. The site failed to generate much business—it accounted for only 2% of the company’s sales in 1999—and, more important, it felt like a real threat to the company’s most valuable asset: its half-million-member independent sales force.

Now, Avon is rethinking its Internet strategy. It is planning to create a site that provides “personal portals” for each of its sales representatives. The reps will use the site to place and track orders, get current information on products, and analyze the buying patterns of their customers—it will, in effect, become the shared “back office” for their individual businesses. Here, again, we see infrastructure intelligence migrating to the core (to Avon) and customer intelligence being pushed to where it can be applied with the highest degree of customization (to the periphery, with the reps). Consolidating the infrastructure provides an important benefit to Avon. One of the company’s biggest problems is high turnover among its sales representatives. The reps, who often work part-time, tend to drift in and out of the work force, and when they leave, they take their customer relationships with them. Now, for the first time, Avon will have centralized information about all its end customers. This information will outline the tenures of the individual representatives and can easily be transferred to new reps.

So what will Avon do with its existing e-commerce site? It will limit its sales to fewer than 500 of the company’s 6,000 products. Customers who want any of the other products will be referred to their local Avon rep, who will call on them in person. The site will now support rather than threaten the reps.

Profiting from Intelligence Migration

In addition to changing the way existing businesses operate, the decoupling and mobilization of network intelligence are opening attractive new business opportunities. Forward-thinking companies are beginning to use four strategies to capitalize on the migration patterns (see the exhibit “Four Strategies for Profiting from Intelligence Migration”):

Arbitrage. Because intelligence can be located anywhere on a network, there are often opportunities for moving particular types of intelligence to new regions or countries where the cost of maintaining the intelligence is lower. Such an arbitrage strategy is particularly useful for people-intensive services that can be delivered over a network, because labor costs tend to vary dramatically across geographies. PeopleSupport, for example, operates a large center in Manila that provides live on-line help services to customers of U.S. companies. By transporting the intelligence of a long-distance support staff over the Internet, the company is able to exploit the difference in labor costs between the Philippines and the United States. The arbitrage strategy can also be used for other people-intensive services like medical transcription, market research, transaction processing, and back office support. Countries in the Indian subcontinent, Eastern Europe, and Latin America provide rich pools of low-cost human resources that can be accessed over a network. Additionally, countries like India with a significant English-speaking population and skilled engineering talent can
provide specialty engineering services for software development, engineering design, architectural design, and statistical analysis.

Aggregation. As intelligence decouples, companies have the opportunity to combine formerly isolated pools of dedicated infrastructure intelligence into a large pool of shared infrastructure that can be provided over a network. Loudcloud, based in Sunnyvale, California, is an example of an emerging new breed of utility that employs the aggregation strategy. Loudcloud offers “instant” infrastructure to e-businesses by converting the various aspects of intelligence required to operate a Web site into a suite of services called Smart Cloud. Each aspect of intelligence is offered as a distinct service, including a Database Cloud (storage), an Application Server Cloud (processing), a Mail Cloud (dispatch), a Staging Cloud (testing), and an eServices Cloud (applications). The Smart Cloud services are coordinated by Opsware—an operating environment that automates tasks such as capacity scaling, configuration, service provisioning, and software updating.

Nike used Loudcloud’s services to accommodate a dramatic traffic surge on its site during the recent Olympic Games in Australia. Opsware enabled Nike to scale up its computing needs on a temporary, just-in-time basis, allowing it to avoid the complexity and expense of expanding its capacity permanently. As Nike’s traffic increased, the site received more server and storage capacity, and when the traffic died down after the Games, Opsware decommissioned the added computers. Loudcloud billed Nike just like a utility does, on the amount of services actually used.

Rewiring. The mobilization of intelligence allows organizations to more tightly coordinate processes with many participants. In essence, this strategy involves creating an information network that all participants connect to and establishing an information exchange standard that allows them to communicate. Consider how the start-up e-Trak is rewiring the information chain for the towing of illegally parked vehicles. The towing process involves a complex sequence of interactions among the police officer at the towing site, the dispatcher in the police station, the towing company, and the towing company’s drivers. Traditionally, the police officer radios the dispatcher in the police station, who then calls various tow companies. The tow companies in turn radio their drivers to find a suitable truck in the area. Once a truck is located, confirmation is passed from the towing company to the dispatcher and back to the officer. This inefficient process takes a lot of time, during which the officer is forced to remain near the vehicle.

E-Trak sets up an information network that connects law enforcement agencies to towing companies. Police officers initiate a tow request through a radio link or a mobile display terminal connected to a network. The tow information is sent to the e-Trak system, which uses a database to automatically select the best towing company based on availability and proximity. The towing company receives the tow information through an e-Trak terminal in its office, and it communicates with the driver via radio, computer, or pager. The e-Trak system has allowed law enforcement agencies to cut response times from 30 minutes to ten minutes, letting them handle twice as many tows without increasing staff.

Reassembly. Another new kind of intermediary creates value by aggregating, reorganizing, and configuring disparate pieces of intelligence into coherent, personalized packages for customers. One example of such a reassembler is Yodlee, a start-up that has developed technology to consolidate and summarize information from multiple on-line sources on one Web site. Users get one-click access to a diverse set of personal information, including bank balances, travel reservations, investments, e-mail, shopping, bills, and calendars, and they can access it from a PC, handheld device, or Web-enabled phone. The Yodlee platform also allows the different pieces of intelligence to communicate with one another by securely and intelligently transmitting personal information across multiple accounts, services, platforms, and devices. For example, severe weather data transmitted to a Web-enabled phone could initiate an automatic call to inquire about potential flight delays for a travel reservation.
What Managers Need to Do

The migration of intelligence raises different sorts of challenges for different companies. To prepare your company, start by undertaking a straightforward analysis. First, define what intelligence is in your business. List the various types of intelligence that exist in your organization, using the table “Aspects of Intelligence in Networks” as a guide. Think about intelligence that resides in objects, such as software applications, databases, and computer systems, conceptualize your organization as a network with a core (the back end) and a periphery (the front end). At the back end, can you centralize processes that are shared across different business units to create an internal “utility company”? Can you convert dedicated infrastructure into shared infrastructure by pushing some business processes beyond the walls of the organization to external utility companies? At the front end, can you get closer to your customers and partners by pushing intelligence nearer to them? Can you allow your customers, your sales force, and your channel partners to access and process intelligence directly, so that they have the ability to configure and personalize it themselves?

Think about the decoupling pattern. Are you making compromises by bundling intelligence that is best centralized with intelligence that is best decentralized? Conceptualize your organization as a network with a core (the back end) and a periphery (the front end). At the back end, can you centralize processes that are shared across different business units to create an internal “utility company”? Can you convert dedicated infrastructure into shared infrastructure by pushing some business processes beyond the walls of the organization to external utility companies? At the front end, can you get closer to your customers and partners by pushing intelligence nearer to them? Can you allow your customers, your sales force, and your channel partners to access and process intelligence directly, so that they have the ability to configure and personalize it themselves?

Think about the mobilization pattern. Are there opportunities to connect, combine, and configure isolated pools of intelligence in creative ways? Reconceptualize your business in terms of the sequences of activities that your customers are trying to accomplish. Think about gaps in the information flows needed to support the sequences. Are you currently doing things in time-consuming, manual ways that could easily be automated if the right information were available? Think about opportunities to rewire your information chains by creating a single network for all your partners. And think about how you might aggregate and reassemble pieces of intelligence from different sources in ways that will save your customers time and effort.

By understanding the implications of intelligence migration for your own company, you will be better able to chart a clear-headed strategy in a time of apparent turmoil. Strategy has always been about finding the right position in a chain of value-creating activities—a position that gives you rather than your competitors control over the flow of profits. That hasn’t changed. What has changed is the nature of the value chain itself. Increasingly, it takes the form of a network.