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THE FOURTEENTH LINK

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## *Network Economy*

TEN YEARS AGO AN EARLY and largely unknown Internet startup was desperately short of cash. As a manager for Time Warner, a member of the startup's directorial board saw these problems as an opportunity for the entertainment giant for which he worked. He therefore suggested to a Time Warner senior executive that they bail out the startup. For a mere \$5 million the media conglomerate could have owned 11 percent of the company. This would have been petty cash for Time Warner and would have offered access to the Internet, at that time a brand new distribution channel. "If we did that," the senior executive replied, meaning that if he accepted the Internet as a viable distribution channel for Time Warner, "then everything we have done since 1923 would be thrown out the window."

He certainly was a terrible stock picker: Ten years later the \$5 million investment would have been worth over \$15 billion. The purchase would have altered history too. Indeed, a decade later Steve Case, the CEO of America Online (AOL), the once unknown Internet startup, and Jerry Levin, the chairman of Time Warner, announced the merger of the two companies at a Manhattan press conference. A few years earlier Time Warner could have easily digested the Internet startup. In 2000, however, it was AOL, a company that few had heard of a decade earlier, that swallowed the media giant.

Time Warner had content, and AOL had the means of delivering it to the consumer. Just before the collapse of the NASDAQ bubble in

spring 2000, Jerry Levin was under pressure to go dot.com to regain Wall Street's attention, and Steve Case needed access to Time Warner's cable to get into your living room. Despite the very different cultures of the two companies, business analysts were eager to convince us that it was a match made in heaven. The same analysts had told us that the 1998 Daimler-Benz takeover of Chrysler also was a sound step for both companies. So was the fusion of the oil industry titans Exxon and Mobil in 1998, four months after another major acquisition in which Amoco was bought by British Petroleum. The list of attention-grabbing mergers and acquisitions does not end here, however. In 1998 alone Bell Atlantic paired up with GTE, SBC Communications bought Ameritech, BankAmerica joined up with NationsBank, Citicorp merged with Travelers Group.

Do these mergers make sense? Not if you listen to antiglobalization activists, who accuse big corporations of dictating everything from policy to fashion. They are unavoidable, however, if we view the economy as a complex network, whose nodes are companies and whose links represent the various economic and financial ties connecting them. Indeed, in a network economy the hubs must get bigger as the network grows. To satisfy their hunger for links, nodes of the business web learn to swallow the smaller nodes, a novel method unseen in other networks. As globalization pressures the nodes to grow bigger, mergers and acquisitions are a natural consequence of an expanding economy.

Motivated by the renaissance of networks in physics and mathematics, recently a number of new findings has documented the power of networks in everything from company structure to the marketplace. We have learned that a sparse network of a few powerful directors controls all major appointments in Fortune 1000 companies; a network of alliances determines the success in the biotech industry; the structure of the network within the firm is responsible for the organization's ability to adapt to rapidly changing market conditions; and strategies taking advantage of the network nature of the consumer base lead to phenomenal successes in marketing. As links and connections take over, understanding network effects become the key to survival in a rapidly evolving new economy.

## 1.

Regardless of industry and scope, the network behind all twentieth century corporations has the same structure: It is a *tree*, where the CEO occupies the root and the bifurcating branches represent the increasingly specialized and nonoverlapping tasks of lower-level managers and workers. Responsibility decays as you move down the branches, ending with the drone executors of orders conceived at the roots.

Despite its pervasiveness, there are many problems with the corporate tree. First, information must be carefully filtered as it rises in the hierarchy. If filtering is less than ideal, the overload at the top level, where all branches meet, could be huge. As a company expands and the tree grows, information at the top level inevitably explodes. Second, integration leads to unexpected organizational rigidity. A typical example comes from Ford's car factories, one of the first manufacturing plants to fully implement the hierarchical organization. The problem was that they got too good at it. Ford's assembly lines became so tightly integrated and optimized that even small modifications in automobile design required shutting down factories for weeks or months. Optimization leads to what some call *Byzantine monoliths*, organizations so overorganized that they are completely inflexible, unable to respond to changes in the business environment.

The tree model is best suited for mass production, which was the way of economic success until recently. These days, however, the value is in ideas and information. We have gotten to the point that we can produce anything that we can dream of. The expensive question now is, what should that be?

As companies face an information explosion and an unprecedented need for flexibility in a rapidly changing marketplace, the corporate model is in the midst of a complete makeover. This does not mean a superficial shift in the job description of a few individuals. It is a fundamental rethinking of how to respond to the new business environment in the postindustrial era, dubbed the information economy.

The most visible element of this remaking is a shift from a tree to a web or a network organization, flat and with lots of cross-links between the nodes. As valuable resources shift from physical assets to bits and information, operations move from vertical to virtual integration, the reach of businesses increasingly expands from domestic to global, the lifetime of inventories decreases from months to hours, business strategy changes from top-down to bottom-up, and workers transform into employees or free agents.

New products require new alliances both within and outside the company, demanding a new topology. To achieve this, layers of middle managers have been scrapped. Employees who previously played secondary roles are in charge of major products from one day to the next. Project teams, alliances within and outside the organization, and outsourcing proliferate. Therefore, companies aiming to compete in a fast-moving marketplace are shifting from a static and optimized tree into a dynamic and evolving web, offering a more malleable, flexible command structure. Those that resist this change could easily be forced to the periphery.

The internal remaking of the web within the firm is only one consequence of a network economy. Another is the realization that companies never work alone. They collaborate with other institutions, adapting business practices proved successful in other organizations. The crucial high-level connection to the rest of the corporate world is often maintained by the CEO and the board of directors. As we will see next, network effects play a fundamental role in these interactions.

## 2.

“I want to say to you absolutely and unequivocally that Ms. Lewinsky told me in no uncertain terms that she did not have a sexual relationship with the President,” read Vernon Jordan at a hastily convened press conference in the midst of the Clinton-Lewinsky scandal. But he soon was to “pull off some of the fanciest footwork of his career—dancing out of the box that he put himself in,” according to *Time* magazine’s Eric Pooley, as everyone pressed him for a satisfactory explanation for the four meetings

and seven phone calls Jordan had with the former White House intern, trying to arrange a job for her at one of several major companies.

Jordan's role in finding Monica Lewinsky a corporate job was no surprise to Washington insiders. His inability to steer the attention away from himself was something new, however. An effective civil rights leader in the 1970s, Jordan was shot in the back in 1980 by a white supremacist, who settled on him after learning that Jesse Jackson, whom he really wanted to kill, was out of town. Jordan carefully had avoided the spotlight ever since, becoming the most powerful unknown in D.C., a rarely heard or seen top deal maker and superlawyer in Washington's media-fixated crowd. As Pooley wrote in *Time*, Jordan "earns \$1 million a year from a law practice that requires him to file no brief and visit no courtroom, because his billable hours tend to be logged in posh restaurants, on cellular telephones, in the tufted-leather backseats of limousines—making a deft introduction here, nudging a legislative position there, ironing out an indelicate situation before it makes the papers."

Uncharacteristically, Jordan found *himself* in the papers all over the nation in 1998, his meetings and phone calls being scrutinized by everyone from the media to independent counsel Kenneth Starr. He emerged as a prominent node in the entangled web of the Clinton-Lewinsky scandal, often dubbed the Six Degrees of Monica.

Jordan was not a newcomer to small worlds. He acquired his unique status as a consummate Washington insider by successfully surfing one of the most influential small-world networks in the American economy, the corporate web. During the years preceding the Clinton-Lewinsky scandal and the Clinton presidency, Jordan became the most central director of the small corporate elite running the Fortune 1000 corporate world.

The board of directors, a group of about a dozen individuals, holds unusual power in overseeing a company's future. It is responsible for all major decisions, from ousting poorly performing CEOs to approving major mergers and acquisitions. Therefore, corporations make all efforts to recruit well-connected and experienced directors. Successful CEOs, lawyers, and politicians are frequently sought after, being courted for directorship on several boards at the same time.

Despite concerns that directors serving on a large number of boards cannot possibly find the time to do justice to all of them, most companies want their directors to have experience on other boards. As directors apply the knowledge and experience they acquired on one board to bear on questions faced by another, this interlocked network of board members plays a crucial role in spreading corporate practices and maintaining the political and economic clout of big corporations.

Thanks to the important role boards play in shaping the landscape of American corporate life, the web of directors has often been scrutinized in business literature. But only recently, with the advent of methods to analyze complex networks, have we started to understand to what degree the power of this web is rooted in its interlocked topology.

In the director network each node is a board member linked to directors serving on the same board. With thousands of companies, each with about a dozen or so directors, this is a rather large web. Gerald F. Davis, Mina Yoo, and Wayne E. Baker, from the University of Michigan Business School, recently studied the most influential component of this web, focusing on the network of Fortune 1000 companies, made up of 10,100 directorships held by 7,682 directors. If each director were to serve on one board only, the network would be broken into tiny, fully connected circles, each the size of a single board. This is not the case, however. While 79 percent of directors serve on only one board, 14 percent serve on two, and about 7 percent serve on three or more. The measurements indicated that these few overlapping directors create a small-world network with five degrees of separation. Indeed, the distance between any two directors belonging to the major cluster, which contains 6,724 directors, was 4.6 handshakes on average.

The small-world nature of the director web is due to the 21 percent of directors who serve on more than one board, since they are the ones who hold this complex network together. Of these, Vernon Jordan plays a very special role. With membership on ten boards, in which he regularly meets 106 other Fortune 1000 directors, Jordan is the most central director of the corporate elite, within three handshakes from most other directors.

### 3.

Jordan's career offers a vivid demonstration of how the interlocked, small-world nature of corporate directorships determines most major appointments in corporate life. Indeed, in most cases when Jordan joined a board, he already knew at least one director from his service on other boards. In the early seventies, as president of the National Urban League, the influential civil rights organization, Jordan repeatedly called for the inclusion of blacks in the powerful corporate elite. In 1972 John Brooks, the chairman of Celanese Corporation, a diversified manufacturer of chemicals, told him, "I think you ought to put your money where your mouth is. . . . You're talking about blacks on the board of directors. Why don't you come on the board at Celanese?"

Soon after joining the board of Celanese, Jordan received two calls inviting him to join the boards of both Marine Midland Bank and Bankers Trust. Undecided as to which he should accept, Jordan called John Brooks for advice. "You don't have a choice. It's Bankers Trust," came the short reply. When Jordan asked why, Brooks answered simply, "How do you think you got nominated to be on the Bankers Trust board? I am on the board. I nominated you." At Bankers Trust Jordan served together with William M. Ellinghaus, who held a directorship at JC Penney as well. A year later Jordan was invited to serve on the board of JC Penney.

Three years later Jordan asked Peter McCullough, the CEO of Xerox, to be the corporate chairman of the National Urban League. He accepted with a condition: "I'll be your corporate chairman if you come on the Xerox board." Jordan agreed. Three years after becoming a Xerox director, Jordan was invited to the board of American Express, where two other Xerox directors already served. It comes as no surprise that in 1980 Jordan joined the board of RJ Reynolds. Indeed, the CEO of Celanese and another JC Penney board member both served on the RJ Reynolds board, and Jordan had close links to the RJ Reynolds CEO as well, who was a fellow director on the Celanese board.

Prior acquaintanceship allows directors to vouch for prospective recruits. Therefore, the small-world dynamics help the creation of a powerful “old boy network,” or corporate elite, that has unparalleled influence in economic and political life. Jordan’s current job at Akin, Gump, Strauss, Hauer & Feld, one of the biggest law practices in Washington, can be also traced back to this old boy network: Robert S. Strauss, the partner responsible for recruiting Jordan, was a fellow director on the Xerox board.

Jordan’s path is by no means unique. Network effects are known to be present in all industries. For example, in Silicon Valley the extensive movements of labor between companies create dense personal inter-company links. These subtle social networks are extensively utilized for hiring new employees and attracting managers. Since current employees can vouch for their social links, just as directors do for fellow board members, employees hired through social networks quit less frequently and perform better than those recruited otherwise.

The intricate and interlocked nature of board directorships and Silicon Valley employees provides just two examples of the complex social and power networks behind the U.S. economy. But to comprehend how an economy truly works, we need to understand how corporations and other economic institutions run by these highly connected directors interact with each other.

#### 4.

Although universities and their spin-offs, small biotech companies, have been recently the driving force behind the development of new drugs, the cash and experience needed to launch large-scale clinical trials and the worldwide marketing channels continue to be located in large chemical and pharmaceutical companies. Because the development and marketing of a new drug can cost anywhere from \$150 million to \$500 million, the different players of this field, ranging from universities and research labs to government agencies, chemical and pharmaceutical companies and venture capital firms, have been forced to form strategic partnerships. These alliances, together with the relatively



young age of the biotech industry, offer an unusually well documented case of network formation, allowing us to follow and understand the emergence of networks in economic systems.

From its early days the biotech industry displayed the essential attributes of a growing network. This growth was captured in a dynamic graph developed by Walter W. Powell, Douglas White, and Kenneth W. Koput, depicting the biotech network at different stages of its evolution between 1988 and 1999. In 1988, representing the early days of the industry, there were far fewer links than nodes: Seventy-nine organizations connected by only thirty-one links. According to the famous Erdős-Rényi prediction, the network should have been broken into many tiny clusters. In reality, however, the nodes formed two major components, one with twenty-seven and the other with four organizations. That is, none of the thirty-one links was wasted—each of them contributed to a major component developing around a few biotech companies, leading to a level of connectedness that could not emerge in a random network. A few hubs visible already at this early stage were the first-mover biotech companies, such as Centocor, Genzyme, Chiron, Alza, and Genentech. Without them the biotech network would have broken into many tiny disconnected nodes.

But the existence of a few companies with a large number of partnerships, resembling hubs, is not enough for us to identify the nature of the network. For this we have to analyze the degree distribution, a study recently performed by two economists, Massimo Riccaboni and Fabio Pammolli, both from the University of Siena, working with physicist Guido Cardarelli from La Sapienza University in Rome, Italy. Their study was based on data collected by the Pharmaceutical Industry Database, hosted by the University of Siena, which provides information for 3,973 research and development agreements between 1,709 firms and institutions. The analysis indicates that the hubs noticed by Powell, White, and Koput are not accidental but are rooted in the scale-free nature of the network behind the pharmaceutical industry. Indeed, the number of companies that entered in partnership with exactly  $k$  other institutions, representing the number of links they have within the network, followed a power law, the signature of a scale-free

topology. A hierarchy of well-connected large corporations brought together a large number of small companies, seamlessly integrating all players into an evolving scale-free economy.

As research, innovation, product development, and marketing become more and more specialized and divorced from each other, we are converging to a network economy in which strategic alliances and partnerships are the means for survival in all industries. The interfirm linkages of suppliers and subcontractors are well documented in southwestern Germany and north central Italy; Japanese business has long relied on interfirm collaborations to diffuse responsibilities for technological innovations; the Korean business model marries a whole array of diverse companies under the umbrella of large conglomerates; Silicon Valley regularly takes advantage of technology transfers by pairing up startups with established companies. These fluid alliances, which are periodically renegotiated as the marketplace shifts or the focus of the participants changes, offer a glimpse of the future of the world's business environment.

## 5.

Despite the important role these interfirm alliances play in the economy, economic theory pays surprisingly little attention to networks. Until recently economists viewed the economy as a set of autonomous and anonymous individuals interacting through the price system only, a model often called the *standard formal model* of economics. The individual actions of companies and consumers were assumed to have little consequence on the state of the market. Instead, the state of the economy was best captured by such aggregate quantities as employment, output, or inflation, ignoring the interrelated microbehavior responsible for these aggregate measures. Companies and corporations were seen as interacting not with each other but rather with "the market," a mythical entity that mediates all economic interactions.

In reality, the market is nothing but a directed network. Companies, firms, corporations, financial institutions, governments, and all potential economic players are the nodes. Links quantify various interac-

tions between these institutions, involving purchases and sales, joint research and marketing projects, and so forth. The *weight* of the links captures the value of the transaction, and the direction points from the provider to the receiver. The structure and evolution of this weighted and directed network determine the outcome of all macroeconomic processes.

As Walter W. Powell writes in *Neither Market nor Hierarchy: Network Forms of Organization*, “in markets the standard strategy is to drive the hardest possible bargain on the immediate exchange. In networks, the preferred option is often creating indebtedness and reliance over the long haul.” Therefore, in a network economy, buyers and suppliers are not competitors but partners. The relationship between them is often very long lasting and stable.

The stability of these links allows companies to concentrate on their core business. If these partnerships break down, the effects can be severe. Most of the time failures handicap only the partners of the broken link. Occasionally, however, they send ripples through the whole economy. As we will see next, macroeconomic failures can throw entire nations into deep financial disarray, while failures in corporate partnerships can severely damage the jewels of the new economy.

## 6.

On February 5, 1997, Somprasong Land, a Thai property development company, failed to pay interest of \$3.1 million on Euro-convertible debt. In a globalized economy where trillions of dollars change hands daily, this is petty cash. Not surprisingly, the event easily evaded the attention of the average investor. Unnoticed by most, this single failure was nevertheless the spark that led to the melting of the world’s financial architecture.

A month later the Thai government made the first in a series of desperate attempts to save the country’s economy from imminent collapse, announcing that it would buy \$3.9 billion in bad property debt from financial institutions. A few days later it reneged on its promise, a move that some financial experts took as a sign of stability. The

International Monetary Fund's managing director, Michel Camdessus, who was later criticized for his organization's role in the Asian financial meltdown, said, "I don't see any reason for this crisis to develop further."

Subsequent events proved him wrong. Two weeks later the financial sector was trembling in Malaysia, prompting its central bank to restrict loans. At the same time, Sammi Steel, the main firm of Korea's twenty-sixth largest conglomerate, sought court receivership, the first step toward bankruptcy. In May, Japan hinted that it would raise interest rates to stop the decline of the yen (which never happened), triggering a global sell-off of Southwest Asian currencies and shaking the local stock markets. A week later Thailand failed to save its largest finance company, Finance One, which effectively went bankrupt. The event triggered a strong speculative attack on Thailand's currency, the baht, which, despite repeated promises to the contrary by the government, was abandoned on July 2.

The cascading failures of companies and financial institutions in Thailand, Indonesia, Malaysia, Korea, and the Philippines would take hundreds of pages to fully document. So would the chronicle of finger-pointing, including such highlights as Malaysian Prime Minister Mahathir Mohamad's bitter attack on "rogue speculators," which culminated in a talk given to the IMF/World Bank annual conference in which he called currency trading immoral. George Soros, the prominent international financier, responded a day later, "Dr. Mahathir is a menace to his own country."

Some economists blamed the "structural and policy distortions in the countries of the region" for the financial meltdown. Yet President Clinton and his economic team in the economic report of the president to the Congress in 1999 maintained that the crisis "was not due to problems with the economic fundamentals." Less than a year after the events, Paul Krugman, professor of economics and international affairs at Princeton, summarized the overall feeling: "It seems safe to say that nobody anticipated anything like the current crisis in Asia." A few small, localized financial difficulties had set off a chain reaction of failures that swept across national boundaries, creating a huge currency de-

valuation and stock market crashes from Asia to South America. It eventually caused the single biggest point loss ever of the Dow Jones industrial average, which tumbled 554.26 points on October 27, 1997.

How could the failure of a large but far from dominant property development company shake the world's largest stock market and keep the president of the "world's strongest nation" explaining even two years after? If we view the economy as a highly interconnected network of companies and financial institutions, we can begin to make sense of these events. In such networks the failure of a node has little effect on the system's integrity. Occasionally, however, the breakdown of some well-selected nodes sets off a cascade of failures that can shake the whole system.

The Asian crisis was a large-scale example of a cascading financial failure similar to those we discussed in Chapter 9, a natural consequence of connectedness and interdependency. It was not the first, however: South America and Mexico had experienced similar cascading failures two years earlier. It is surely not the last either, despite all the measures banks and governments seem to have taken to avoid it.

These events cannot be explained within a framework in which all organizations interact with a mythical market only. Cascading failures are a direct consequence of a network economy, of interdependencies induced by the fact that in a global economy no institution can work alone. Understanding macroeconomic interdependencies in terms of networks can help us to foresee and limit future crises. Thinking networks can teach us to monitor the path of the damage and to set firewalls by identifying and strengthening the nodes that can stop the spread of macroeconomic fires.

We should not let ourselves believe that such cascading failures as the Asian crisis and its Latin American counterparts are the side effects of the unstable financial systems of rapidly developing nations. Established economies, such as the United States', that have the cash and the expertise to root out such failures before they turn global aren't immune to cascading failures. Vulnerabilities related to interconnectivity exist in stable economies as well, as the burst of the dot.com bubble illustrates.

## 7.

In late 1999, Compaq's Pocket PC became the company's biggest hit. As discussed by a recent *Strategy & Business* study, demand for the device outpaced supply twenty-five times, making some Compaq executives dream that, with support and accessories, the handheld devices could soon offer a bigger market than traditional PCs. Then problems started surfacing.

Compaq, Cisco Systems, and several other companies are leaders of a new business strategy: outsourcing. Cisco, which not long ago was poised to become the first trillion-dollar company, is the driving force behind this trend. It reached a 30 to 40 percent annual revenue growth with a novel and aggressive approach to manufacturing: It didn't build anything that it sold. Rather, it established strong ties to a large number of manufacturers who built and assembled the pieces sold under Cisco's logo. Compaq and many others followed suit.

Outsourcing requires a tight integration of suppliers, making sure that all pieces arrive just in time. Therefore, when some suppliers were unable to deliver certain basic components like capacitors and flash memory, Compaq's network was paralyzed. The company was looking at 600,000 to 700,000 unfilled orders in handheld devices. The \$499 Pocket PCs were selling for \$700 to \$800 at auctions on eBay and Amazon.com. Cisco experienced a different but equally damaging problem: When orders dried up, Cisco neglected to turn off its supply chain, resulting in a 300 percent ballooning of its raw materials inventory.

The final numbers are frightening: The aggregate market value loss between March 2000 and March 2001 of the twelve major companies that adopted outsourcing—Cisco, Dell, Compaq, Gateway, Apple, IBM, Lucent, Hewlett-Packard, Motorola, Ericsson, Nokia, and Nortel—exceeded \$1.2 trillion. The painful experience of these companies and their investors is a vivid demonstration of the consequences of ignoring network effects. A *me* attitude, where the company's immediate financial balance is the only factor, limits network thinking. Not understanding how the actions of one node affect other nodes easily cripples whole segments of the network.

Experts agree that such rippling losses are not an inevitable downside of the network economy. Rather, these companies failed because they outsourced their manufacturing without fully understanding the changes required in their business models. Hierarchical thinking does not fit a network economy. In traditional organizations, rapid shifts can be made within the organization, with any resulting losses being offset by gains in other parts of the hierarchy. In a network economy each node must be profitable. Failing to understand this, the big players of the network game exposed themselves to the risks of connectedness without benefiting from its advantages. When problems arose, they failed to make the right, tough decisions, such as shutting down the supply line in Cisco's case, and got into even bigger trouble.

At both the macro- and the microeconomic level, the network economy is here to stay. Despite some high-profile losses, outsourcing will be increasingly common. Financial interdependencies, ignoring national and continental boundaries, will only be strengthened with globalization. A revolution in management is in the making. It will take a new, network-oriented view of the economy and an understanding of the consequences of interconnectedness to smooth the way.

## 8.

Sabeer Bhatia did not know how to sell a company. But having been born and raised in India, he did know how to buy onions. You have to negotiate. Now he had a very hot onion to sell. He and his partner, Jack Smith, on July 4, 1996, launched a service offering nothing but e-mail—free to anybody in the world. They named it Hotmail. By year's end they had signed up a million customers, each of whom view daily the banner ads displayed on their e-mail account, Hotmail's main source of revenue. When Microsoft came knocking a year later, nearly 10 million users had Hotmail accounts. Bhatia was only twenty-eight when, after touring all twenty-six buildings at Microsoft's Redmond, Washington, empire and shaking hands with Bill Gates, he was ushered into a room packed with twelve Microsoft negotiators. They offered him \$160 million. "I'll get back to you," he said, and walked away.

Currently Hotmail has about a quarter of all e-mail accounts. It is the biggest e-mail service provider in Sweden and India, countries in which it has never advertised. Microsoft eventually paid \$400 million for the company, which a year later, before the burst of the dot.com bubble, was worth \$6 billion.

How did an underfunded startup sign up a quarter of all e-mail users? The answer is simple: They exploited the power of networks, using a hot new marketing technique called viral marketing. Viral marketing works on the same principle that allowed Love Bug to circle the globe in a few hours. The computer virus reached everybody by looking up the e-mail list you store in your Microsoft Outlook program, sending a copy of itself to each address. Thanks to a similar innovation, Hotmail users voluntarily offer the same service.

Tim Draper, from the Draper, Fisher and Jurvetson venture capital firm, after providing \$300,000 seed money to launch Hotmail, persuaded Bhatia and Smith to add an extra line at the end of each email: "Get Your Private, Free Email at <http://www.hotmail.com>." Therefore, whenever Hotmail users send e-mails to their friends, they advertise and endorse the company. The news about Hotmail travels on a scale-free network, utilizing exactly the same routes that helped the spread of Love Bug. Because the critical threshold for innovation spreading vanishes on such networks, it was likely that Hotmail would succeed. It was unexpected and surprising, however, how fast and to what degree it did.

What is the source of Hotmail's phenomenal success? The answer is partially contained in the Trieste study discussed in Chapter 10. Innovations and products with a higher spreading rate have a higher chance of reaching a large fraction of the network. Hotmail enhanced its spreading rate by eliminating the adoption threshold individuals experience. First, it is free; thus you do not have to think about whether you are making a wise investment. Second, the Hotmail interface makes it very easy to sign up. In two minutes you have an account; thus there is no time investment. Third, once you sign up, every time you send an e-mail, you offer free advertisement for Hotmail. Combine these three features, and you get a service that has a



very high infection rate, a built-in mechanism to spread. Traditional marketing theories will tell you that the combination of free service, low learning path, and rapid reach through consumer marketing has put the product above the threshold, and that is why it reached everybody. Based on our new understanding of diffusion in complex networks, we now know that this is only partially correct. It is true that you have a very high rate of spread. But you have no threshold either. Products and ideas spread by being adapted by hubs, the highly connected nodes of the consumer network.

Can Hotmail be replicated? Don't bet on it. Take for example EpidemicMarketing.com, a company that spent \$2.1 million on a thirty-second Super Bowl advertisement in 2000, dreaming big to exploit the power of networks. In the Super Bowl ad a man visits a public restroom and receives a tip from the washroom attendant, instead of tipping the attendant as is customary. As was so cleverly expressed in their commercial, Epidemic planned to reward people for doing things they do every day. Their business model was to pay consumers to attach links to Internet businesses on their outgoing e-mail. Therefore, information about a company or promotion was expected to spread largely through word of mouth, replicating the phenomenal success of Hotmail. The model was missing a crucial element of viral marketing, however: Your friend had little interest in passing on the link to his or her acquaintances. It comes as no surprise, therefore, that Epidemic closed its doors and laid off its sixty-person staff in June 2000 after burning through the \$7.6 million it raised.

Hotmail demonstrates the power of consumer networks. Some products do not need expensive telemarketing or TV and newspaper ads to prevail. They simply spread by word of mouth like a virus. Though it may not work for all products, throwing in elements of viral marketing could enhance just about all sales. Yet Epidemic's failure indicates that Hotmail cannot be easily copied. Instead, Hotmail's experience should be the starting point for new marketing approaches, combining traditional strategies with a better understanding of network effects.

## 9.

Network effects proliferate in the business world. We saw Vernon Jordan successfully surf the complex corporate network, becoming an influential member of the corporate elite. We saw Hotmail take advantage of the scale-free nature of the consumer network to become the biggest e-mail provider worldwide. The list does not stop here. Motivated by the evolving marketplace, an array of new companies have lately vowed to put network thinking at the core of their business models. Their record is mixed at best.

Take for example SixDegrees.com, a New York-based startup that asked its members to submit the names of their friends, inviting them to join too. If they enrolled, they also submitted the names of *their* friends. Step by step SixDegrees acquired a detailed map of the social network around each of its members, allowing them to reach everybody two links away from them. This consumer-driven viral marketing allowed SixDegrees to sign up over 3 million consumers. Yet the startup closed its doors on December 30, 2000, failing to turn six degrees into a viable business plan.

The burst of the dot.com bubble is often attributed to the one-dimensional thinking of many Internet enthusiasts. Most startups were based on the simple philosophy that offering things online was sufficient to replicate the success stories of the new economy. Yet, apart from a few early starts, such as Amazon.com, AOL, or eBay, most failed. The real legacy of the Internet is not the birth of thousands of new online companies but the transformation of existing businesses. We can see its signature on everything from mom-and-pop stores to large multinational agglomerates.

Networks do not offer a miracle drug, a strategy that makes you invincible in any business environment. The truly important role networks play is in helping existing organizations adapt to rapidly changing market conditions. The very concept of network implies a multidimensional approach.

The diversity of networks in business and the economy is mind-boggling. There are policy networks, ownership networks, collaboration networks, organizational networks, network marketing—you name it. It would be impossible to integrate these diverse interactions into a single all-encompassing web. Yet no matter what organizational level we look at, the same robust and universal laws that govern nature's webs seem to greet us. The challenge is for economic and network research alike to put these laws into practice.