Hijacking the World:
The Dark Side of Microsoft

by

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Chapter 1

Big brother?

Dominique Nora: *Microsoft has a quasi-monopoly in some information technology sectors, such as operating systems and application software, but its sales only represent 2% of total hardware and software sales in the world. If this is the case, why should we be worried about its domination, as you are suggesting all throughout this book?*

Roberto Di Cosmo: This figure of 2% is not the correct number to examine. It gives a false impression that Microsoft, as a software publishing company, is just a minor player in the computer business, because it is mixed in with companies whose activities have nothing to do with what it does, in sectors that go from manufacturing computers to making ATM machines (hardware, software, services and semi-conductors).

Examining other statistics can give a better view of Microsoft's power: if you look at the profits of the ten leading software companies in the world, Microsoft alone accounts for 41% of these profits. Also, Microsoft operating systems are used on more than 85% of personal computers sold around the world. In any case, these figures are not the best indicator to understand the phenomenon that I am denouncing: to control an industry with a scope as wide as the computer industry, a company does not necessarily need to control 90% of its sales. Take an example from revolutions: to overthrow a government, do rebel forces try to secure control of the entire territory of a country? No, they only need to conquer the 0.1% of the country's activities that are considered as strategic: radio stations, television stations, the telephone network and a few key institutions, such as the army or the central bank. For economic activities, it's the same thing: some strategic elements that are more important than others.

The term currently used, "information society", gives a good indication of what is at stake: it is difficult to find a more important product in today's economy than information, or services more strategic than those dealing with its creation, transmission and manipulation. If one company alone (such as Microsoft) manages to obtain a quasi-monopoly over the worldwide information and communication chain, as they are attempting to do, this could be a danger for democracy. Information systems are more strategic now than oil and its pipelines were in the recent past. They have fully penetrated our daily life, not only for businesses, but for the general public as well. Computers are already beginning to shape the way we learn, the way we work,

the way we entertain ourselves, the way we heal ourselves, the way we consume, and also the way we formulate our opinions.

But Microsoft is not the only powerful player in this sector. Isn't the chipmaker Intel in a very similar position?

It is true that Intel, the world's leading microprocessor company, has adopted a similar strategy of conquest, that has also attracted the attention of the Antitrust Division of the US Department of Justice. Microsoft and Intel work together very closely: Intel designs new, faster chips, to run Microsoft programs which are larger and require more resources, that then make it necessary for you to purchase a new computer that runs more quickly. Because of this, these two companies are getting more and more of your money. People speak of the "Wintel" standard — a contraction of Windows and Intel —, and this standard now accounts for 90% of the personal computer market. But chips are less strategic than software: it is much easier to clone a chip than it is to copy a complex program. And it is also relatively simple to port an operating system from one chip to another, even if the chip manufacturer attempts to prevent this operation, using all the means at its disposal, be they legal or not (note 2). For example, AMD, Cyrix and IBM all make chips that can run Windows just as well as Intel, and that cost much less.

This makes it difficult to control the information chain starting with the chip, even though Intel has tried to do so by offering money to content providers who accept that their Web sites be "optimized" for Intel chips; this means they cannot be used by someone running a computer with a competitor's chip in it (note 3).

Let's come back to Microsoft. Is it really relevant to make a comparison with Orwell's idea of "Big Brother"?

The current threat is far worse! In *1984*, Big Brother used cameras to watch over people, but these people were still free to hide their thoughts. Above all, they knew that they were being watched, and were always on their guard, ready to fight to get their freedom back. But in today's world of computers, people have total trust in the information technologies they use to exchange e-mail, talk on mobile telephones, make travel plans, write memos, manage their money and their investments, buy things — this covers almost all the private and social activities that people are involved in. Companies trust all their strategic secrets to computer networks. It is technically possible to find traces of all this information, without your knowledge and without using cameras that are easily seen. For example, it is easy to find out who Dominique Nora called on her cell phone at 3 o'clock in the morning last night, where she was, what she typed on her computer, and what she said to someone in an e-mail message. You can see that this information concerns your privacy much more than merely watching over you with a camera, which could be easily spotted. Especially if all this information falls into the hands of one company. Compared to that, believe me, Orwell's Big Brother is just a choirboy.

Do you mean that Microsoft has a diabolical plan to control our lives?

No, don't worry, I'm not so paranoid as to think there is a conspiracy. What motivates Microsoft is its dread of loosing its dominant position. But if you consider its motto, which is "Embrace and extend", and the objective that it announces, which involves taking control of the entire information and communication chain (in the short term this means controlling the Internet), Microsoft is currently creating a technological instrument that may effectively be used to control our lives. Once this instrument exists, there will be someone — even if it is not Microsoft — who will use it for that purpose! There is an interesting precedent concerning viruses: Microsoft systems contain many security loopholes, that hundreds of virus programmers have taken advantage of, to the great displeasure of many computer users (see chapter 2).

But if Microsoft does effectively manage to dominate operating systems for personal computers, communication networks, web browsers and the brains for servers used to make up the Internet, the corporation would be in a position with much more control than a company, in the past, that would have owned all of the world's printing presses! It would actually have the power to make insidious decisions as to who would have access to information, and which information you could access. Have you ever noticed that when you surf the Web using Microsoft's competitor's browser, Netscape Navigator, or Netscape Communicator, there are some sites that it does not read very well because the content is "optimized" for Internet Explorer? Why? Because Microsoft has managed to convince content providers that its browser, Internet Explorer, has become the standard, and that it is in their interest to adapt their Web site for that browser alone.

But this is just a beginning: Microsoft's hegemony over operating systems, browsers, and servers could enable it to take control of all network standards. It is important to point out that the Internet today operates because of open standards, languages, protocols and interfaces that are public and well-documented: the HTML language that is used to make Web pages, the TCP/IP protocol used to transmit data, the Berkeley Internet Name Daemon (that makes it possible for you to type "dmi.ens.fr" rather than "129.199.96.11"), the Perl programming language used by most Web servers; these are just a few examples. If you were to remove all these components based on open standards and open source software from the Internet, you would simply have no more Internet! Open and public interfaces, and properly documented procedures developed without restrictions from commercial considerations, have been the cornerstones that have allowed this network of networks to develop. Because of these elements, any computer user can freely exchange information with anyone else, whether they use a Macintosh, a PC, a Sun, HP, Digital, IBM or NeXT workstation, an Atari, an Amiga, or an old terminal.

If, one day, there are only Windows NT servers, and Windows 98 computers using Internet Explorer, who can guarantee that these machines would not speak to each other exclusively in "Microsoftese"? If this occurred there would be two types of consequences. First, this would undermine interoperability, which is the compatibility among different components: no competitor could try to sell products that would function harmoniously with Microsoft products without having access to a "Microsoftese" dictionary, and that may not be so easy to obtain.

Second, without this dictionary, no one would be able to understand or verify what these computers are saying to each other! This could bring up many freedom and privacy questions. For example, imagine that you are quietly reading a Web page, and your personal computer, without your knowledge, is giving the server you are consulting your address, age, telephone number, the type of computer you have, how much money you have in the bank, and the contents of your entire hard disk…

Why would it want to do that?

Because, in an ultra-competitive globalized economy, your consumer profile is worth its weight in gold. If someone knows what your cultural interests are, what cities you would like to visit, what products interest you and what toys your children like, they will be able to propose goods and services that correspond exactly to your tastes. There already are, in fact, examples of this on the Web, with files that are called cookies, that allow servers to discover which sites you have visited on the Web without your knowing (note 4). These practices have been discovered and denounced, because these technologies are currently based on open standards, which is an essential condition to ensure that cookies can be accepted by Netscape's browser as well as Internet Explorer, Opera, Lynx, and all the other browsers that exist. But if this information is coded in a proprietary language, no one will be able to know what their computer is "saying" to the network. The companies that gather this data tell us that it is for our own good: to be a step ahead of our desires. But do we really want to give up our free will in the name of commercial "do-gooders"?

People in Europe tend to be a bit shy about saying these things. Microsoft is criticized because people here are afraid of American cultural imperialism, or because they're afraid of globalization, and Bill Gates is an emblem for this, or simply because they're scared to death by technology…

My reasons for criticizing Microsoft are much more basic, and, I think, less subjective than that. I have a deep love for technology, and it is exactly for this reason that I cannot accept seeing it corrupted by a company that designs bad products, which are sold too expensively to consumers who are subjugated by them, a company that — we will see how later — has contempt for its customers, does not play fairly with its competitors, and stifles innovation. Like many others, I cherish a dream of technological progress leading to a better world, a world that is freer and has more solidarity. But I can ensure you that such a world looks nothing like the world that Bill Gates dreams of.

You may recall the futuristic video that Microsoft made for his Lakeside High School anniversary in February 1995 that was later aired on TV. It showed our technological future as a negative world, a narrow-minded, highly commercial police state, that looks nothing like a dream, but rather like a nightmare to me.

Let's take stock of the markets that Microsoft dominates today, and those it hopes to conquer. In other words, how much of the disaster scenario you describe is objective reality and how much is pessimistic prediction?

The situation is clear: the world of PC software is almost entirely owned by Microsoft. With Windows 98, this company will probably dominate 90% to 95% of operating systems and office software within the next year. Already, an overwhelming majority of the general public use Word as their word processing software and Excel as their spreadsheet. Microsoft is also one of the leading edutainment software publishers, with more than fifty titles including the *Encarta* encyclopedia and *Flight Simulator.*

Using this incredible fortress as a base, Microsoft is trying, using questionable methods, to export its monopoly in three major directions. First, the corporate computer market. With the incredible increase in computer calculating power, tasks that were once only handled by mainframes can now be accomplished by personal computers linked across a network. Microsoft offers companies a "digital nervous system" based on its Windows NT (New Technology) operating system. The company is attempting to get a foothold in a market that has been traditionally dominated by IBM, Digital, Sun, Hewlett Packard and others. The second area they wish to conquer is the Internet. While Microsoft originally paid no attention to the Internet, in 1995 it abruptly became their main sphere of development. In addition to fighting to obtain Web browser market share, Microsoft is trying to sell its software for Web servers, and designing programs for developing Web content. The Microsoft Network, or MSN, its online service, never really took off as a service provider, but it is being redesigned as a portal called msn.com (note 5)*:* this is an entry point to the Internet, which funnels Web surfers and sells their presence to advertisers, or sends them on to partner sites. Microsoft already runs more than a dozen Web sites that provide content and services: MSNBC (in a partnership with the NBC television network) and the electronic newsletter *Slate* give news and information, Sidewalk is an arts and entertainment guide for several major American cities, CarPoint sells cars, Expedia sells travel services, Investor gives financial advice and HomeAdvisor sells mortgages.

While everyone is only looking at today's markets, Microsoft is also trying to invent the future: the television of tomorrow, for example…

The company's third sphere of development involves prefiguring (and not inventing, something Microsoft has never been able to do) the media of tomorrow. Bill Gates knows perfectly well, and this is his main worry, that personal computers will not be the only tool for using the Internet for much longer. Means of access to the Internet will diversify. This is leading Microsoft to try and impose its solutions and standards on all the emerging niches: Microsoft is trying to impose Windows CE as the standard operating system for PDAs (Personal Digital Assistants), even if, as usual, the best products of this type (such as the PalmPilot or the Psion) do not use it.

Microsoft is hoping that, in the near future, Windows CE will be at the heart of interactive television set top boxes, next-generation video game consoles, such as Sega's Dreamcast, Internet telephones, smart cards and on-board automobile computers.

To better follow the evolution of the television market, Microsoft invested in the American cable television company Comcast, and more recently in the French television manufacturer Thomson Multimedia (maker of the General Electric and Proscan television brands). Microsoft can now offer a full set-top box, developed using the Web TV technology that they purchased. Large quantities of these devices have already been ordered by the leading American cable TV company TCI.

Microsoft also purchased, together with Compaq, 20% of a company called RoadRunner, a subsidiary of Time Warner specialized in cable Internet access.

If the brains of the digital machines that we use were "Microsoftened", each of us would have to pay the "Microsoft tax" many times: when we turn on our television or computer, when we make a phone call, when we go shopping on the Internet, when we work, or when we drive…

Bill Gates has also invested part of his personal fortune in information technologies.

Up until now, I have been talking about Microsoft, and rarely about Bill Gates himself. Gates is the cofounder of Microsoft, and owner of 20% of the company's stock; his net worth is approximately $72 billion (as of Decemebre 1998). I find it unhealthy that the medias pay so much attention to the person who has become the richest entrepreneur in the world. For some people, his wealth is a reason to be fascinated; for others it is a cause for jealousy, and can even lead them to demonize him. This personalization may actually cause the main issue to be hidden: the reprehensible conduct of Microsoft, that is managed not by just one man, but by a team of managers, the three most important of whom are Steve Ballmer, President, Bob Herbold, Executive Vice President and Chief Operating Officer, and Nathan Myrvold, Chief Technology Officer.

It is true that Bill Gates has invested some of his personal wealth in two sectors of this industry that are both strategic and highly complementary to Microsoft's activities. These investments show, if need be, that Gates is a shrewd businessman. One of these investments, Corbis, a company wholly owned by Bill Gates, has, over recent years, inexpensively acquired electronic reproduction rights for some 20 million paintings belonging to the world's great museums (the Hermitage in Saint-Petersburg, the National Gallery in London) or historic photographs such as those from the Bettman Archives in New York. It is rare today that magazines such as *Newsweek* and *Time* publish an issue without at least one Corbis photo. At first, the people in charge of these archives and museums had no idea of the real value of digital reproduction rights for works of art. Electronic media did not yet exist, and they could not imagine what use could be made of these images. It was for this reason that Gates almost managed to purchase reproduction rights for the masterpieces in the Louvre Museum for a song…

The other major investment, the company Teledesic, cofounded by Bill Gates with the American entrepreneur Craig McCaw (who made his fortune with cellular telephony), is developing a project to build a sort of Internet in the sky, by launching two hundred and eighty-eight low-orbit communication satellites. This infrastructure, designed to transmit voice and data at a very high bandwidth, could begin competing with land-based networks and classical telecommunication operators in 2003. Motorola, who was working on a competing project until May 1998, recently joined this multi-billion dollar experiment… The only remaining competitor is the Skybridge project, a joint venture between the American company Loral and the French Alcatel.

It seems incredible that it has taken so long to discover the Microsoft "problem". How did this Redmond start-up manage to build a global operating system monopoly in the past twenty-three years?

Well, let's begin by separating the true history of Microsoft from its surrounding layers of myths. Bill Gates and his schoolmate Paul Allen did not, as is often mentioned, "invent" the Basic programming language, which was written by John Kemeny and Thomas Kurtz (Dartmouth College, 1964). They simply created an "interpreter" for Basic, which was used by the early Altair personal computers. Let's look back at the context of the nineteen-seventies. Other than organizations like the CIA, NASA or large corporations like the Bank of America, computers were totally inaccessible. Only governments, large corporations or banks could afford these huge computers that took up an incredible amount of space. Also, IBM did not sell its computers, but rented them and sold its customers maintenance contracts. IBM guaranteed the quality of its products and handled all repairs. This is how it developed such prestige among its customers, and also how it made such huge profits. But, to send men to the moon, it was necessary to design smaller, lighter computers that would fit in space capsules. American taxpayers' money was used to develop the earliest integrated circuits, silicon chips that progressively became cheaper. Small companies were set up to assemble these electronic components that were now available on the open market. This entrepreneurial melting pot led to the invention of the first personal computers, such as the Apple II in California or the Micral in France. It should be mentioned that in the beginning PC was a generic term that meant personal computer. Only recently has this term been used to designate only "IBM-compatible" computers, that is, those that use Intel chips.

In any case, at the beginning, PCs were just for hobbyists. They were not at all user-friendly and it took a whole lot of complicated maneuvers just to add 2 + 2! There was nothing yet to worry IBM. It was near the end of the 1970s, when programs such as Visicalc were developed, that small companies and stores started using personal computers for their accounting. Complex statistical and financial simulations, which had previously required forty accountants writing numbers on huge blackboards, were suddenly accessible, and at a reasonable cost.

So, when the first Apple and Commodore computers were manufactured, a real business started developing. IBM was worried about maintaining its quasi-monopoly on the computer industry, and it wanted to cut off the flourishing growth of these tiny competitors. It needed to quickly

come up with a product bearing the IBM name… even though it did not really believe in the future of the PC. There is one telling example of how little faith IBM had in the future of personal computers: while all its mainframe computers were entirely made up of IBM parts, even down to the screws used to keep the covers on, the only IBM parts in the first IBM PCs were the keyboards. The rest of them were made of parts that were bought on the open market: Intel supplied the 8088 processor, and Microsoft, a start-up created in 1975, was called on to supply the operating system.

Why Microsoft? There is no rational reason behind this choice, since Allen and Gates were not at all working on this type of product at the time, and there were other well-designed and efficient operating systems that could be used for PCs, such as Digital Research's CP-M. This didn't bother them. IBM did not know very much about this part of the market, and Microsoft, seeing that opportunity was knocking, bought (and did not invent, as the legend says) the Q-DOS operating system from a small business called Seattle Computer for $50,000. Q-DOS is an acronym which means Quick and Dirty Operating System.

Microsoft used this to make MS-DOS, and IBM purchased a license to use it on its computers. IBM-PCs were of much lower quality than the Apple II, but IBM's sales force and service made the difference. IBM salesmen basically said to its customers: "Buy our PCs. If they break down, we'll fix them or exchange them within forty-eight hours". As for the Apple II, it was sold by guys who sold stereos!

But IBM never took PCs very seriously: this huge company never bothered to purchase MS-DOS, it never even ensured that it would have an exclusivity. The result was that Microsoft was able to sell MS-DOS, and then its successor Windows, to all of Big Blue's competitors. At this time, computer manufacturers dominated the industry. No one thought that the standardization around Intel and Microsoft products, and the appearance of Asian clones, would make it such that all the profits, and power, of the computer industry would be concentrated in chips and operating systems. The rest is history.

But Microsoft's incredible success cannot be reduced to a series of lucky strokes. What qualities do Bill Gates and his management team have that have helped them succeed?

We have already seen, when talking about IBM, that the founders of Microsoft were very pragmatic businessmen, rather than technological visionaries. They had a remarkable flair for spotting opportunities, and filling a need before others, although they did this with mediocre products. But they have done this so well over the past ten years, that Microsoft has an annual growth in sales of 42%, and its profits increase annually on an average of 48%. For the year ending June 1998, Microsoft had $4.5 billion in net profits on sales of $14.48 billion. Since the company does not know what to do with all its cash, which exceeds $60 billion, it is massively buying back its own shares of stock.

We must recognize that Microsoft does have a special talent for finding exactly what the market needs, which, unfortunately, has nothing to do with the quality of its products. Its reactivity to

the rising phenomenon of the Internet, for example, was spectacular. Microsoft did not really understand the potential of this worldwide network until it saw the growing popularity of Netscape's browser. In 1995, this huge company, with 25,000 employees, needed only a few months to make an about-face and decide that the Internet would be its key sphere of development. It knew very little about computer networking. The earliest versions of its spreadsheet, Excel, did not even have the possibility for users from different countries to exchange spreadsheet documents. Its macro language (a simple programming language used to manipulate data in spreadsheets) was written in the language of the country where the product was distributed, which meant that the similar versions of Excel sold, say, in France and in the United States, could not understand each other. Even a first-year computer science student would know what to do so they could communicate correctly!

But, over the years, Microsoft has acquired a remarkable ability to convert its technical failures into commercial successes. While its new programs are often disastrous, the big guns in its marketing department manage to sell them anyway, convincing people to wait for the future versions which slowly correct their bugs to make them more stable, or sometimes by buying or copying the often better programs sold by its competitors. Microsoft has managed to make people think that the problems with its programs are normal, and that corrections to these problems are technological breakthroughs. Even better - it is the consumer who pays for improving its products!

The company is now so rich that it can afford to go ahead by trial and error, investing a few hundred million dollars here and a few hundred million dollars there, just to see what happens. If a project is not a success, it changes it until it works. This is exactly what happened with its online service MSN. In 1994, Microsoft thought that all it needed to do was create a proprietary online service, with an icon on the Windows desktop for users to access it. It felt that it could compete with the leaders in this field, such as America Online. But in mid-1998, MSN had reached a peak of only 2 million subscribers, versus 13 million for AOL. The French version of MSN was merged with France Telecom's Wanadoo; the German version was simply closed down. So, once again, when Microsoft can't get what it wants using its own qualities, it just buys it: the company recently bought the HotMail free e-mail service, which had, at the time, 9 million subscribers (as of November 30, 1998, Hotmail had 30 million subscribers).

In spite of its spectacular success, Microsoft is kept in a permanent state of paranoia by its leaders. "Only paranoids survive", says Andy Grove, the co-founder of Intel. Microsoft's leaders are motivated by this feeling of vulnerability; and by their stock-options. Since the company went public, in 1986, the value of these shares has grown by more than 25,000%

Do the offensives made by Microsoft and Bill Gates succeed in all areas?

If you look at the history of Microsoft products, you can realize that this "risk" is real. The first versions of the Excel spreadsheet program had so many design flaws that I would have given an F to any of my students who had written it. But Excel today has 50% market share in the world, for sales as a separate application, and Office, that includes Excel, has 93% market

share. The Windows 3.0 operating system was at least ten years behind Apple's Mac OS; its successors, Windows 95 and Windows 98, today have a 90% share of the world market, in terms of current sales, compared to less than 4% for Apple. You can also look at what is happening for enterprise servers: Microsoft's Windows NT operating system has, in two years, already taken 36% of the market for new servers (Unix still dominates this market, because of its installed base). The same thing has occurred with the Internet Explorer browser, which has managed to take 55% of the market in less than four years. In all of these situations, Microsoft's products were, originally, greatly inferior to those of its competitors, and in some cases they remain so even today.

This long series of precedents shows that we need to be vigilant. It is quite easy to impose a mediocre product if its sale is linked with a product where you have a monopoly. If Microsoft had conquered these markets loyally, with good programs written correctly, and if the company's strength only came from the quality of its products, no one would have any complaints. But the Justice Department opened an antitrust investigation against Microsoft as early as 1993. It was the largest investigation of its type carried out in two decades, and follows the famous example of other antitrust cases with Standard Oil company (1911) (note 6), IBM (1984, led by the EEC) and AT&T (1988). Why would a government that believes so strongly in a free market, and considers the success of its entrepreneurs so important, want to clip the wings of one of its leading companies, if there were nothing seriously reprehensible about Microsoft's practices?

Let's examine the Justice Department's case against Microsoft. What exactly is the company accused of?

The antitrust case against Microsoft is complex, and it is important to distinguish the federal government's suit from those made by the different states, as well as those of its many competitors and partners that consider that they have been cheated. We will see later that some of these companies accuse Microsoft of modifying its programs so its competitors' products will not function correctly. Twenty American states filed a class action suit to investigate accusations that Microsoft has abused its dominant position in the software market, especially concerning its Office suite. As for the federal government, let's first look at the history of its different investigations. The Justice Department began investigating Microsoft in 1993. But after two long years of investigation, the only result was a relatively limited Consent Decree, in 1995. The Antitrust Division of the Justice Department today considers that Microsoft did not respect the terms of this decree. This is why they filed new suits in May 1997. This is also why they have increased the scope of their investigation to include Microsoft's commercial practices.

To sum up years of complex legal procedures and documents, the Justice Department accuses Microsoft of three types of activities: first, the fact that it imposes inequitable exclusive contracts on its partners or hardware manufacturers. Companies like Dell, Compaq and IBM apparently do not have the right, if they wish to purchase software at competitive prices, to sell their computers without Windows, or with an Internet browser other than Internet Explorer. This deprives the end user of their right to choose (see more about this in chapter 3).

This part of the suit seems to be the least difficult to prove. It is said that Microsoft's partners would be delighted to have a bit more flexibility with respect to the software giant. But they are very worried about retaliation. The hardware market, unlike the software market, has very low profit margins, and no company can run the risk of losing its advantageous Microsoft license. Each hardware manufacturer is waiting for someone else to throw the first stone at Microsoft.

The second of the Justice Department's criticisms of Microsoft involves its linking new programs with the Windows operating system, which is a sector where the company has a quasi-monopoly. This means that for each of the products linked to Windows — yesterday it was the Office suite, today the Internet Explorer browser or Outlook PIM; tomorrow who knows, perhaps a voice recognition program — none of its competitors can compete with Microsoft, even if they have high quality products. Finally, antitrust investigators are examining a whole set of coercive practices that Microsoft has used toward Intel, IBM, Apple, as well as Internet service providers, World Wide Web content providers, and the designers of some Internet audio and video transmission programs.

But the Justice Department is on thin ice with these accusations because there is very little jurisprudence for this sort of technology. Microsoft takes advantage of this by saying that these evolutions of the Windows operating system are innovations that are in the consumer's best interest. This may work out in its favor because the US Supreme Court has already decided that it is not up to the justice system to define which functions a computer operating system may contain. The problem is that all this legal quibbling is hiding the real stakes of monopolistic control of information.

What do you hope will come out of this trial?

Let me first say how surprised I am that when companies are found guilty of illegal actions in cases like this, they often do not have to pay any substantial punitive damages. This is exactly what happened in 1995. Instead of Microsoft paying a fine, it only had to sign a Consent Decree, promising that it would behave better. It was later able to circumvent this Consent Decree because it was so imprecisely drafted. It was as if a court were judging someone who had stolen a Mercedes and was caught red-handed, and, when sentenced, he was told he could keep the car, as long as he never stole the same type of car again exactly in the same way!

Coming back to the main issue, the most efficient decision — one that consumer advocate Ralph Nader is calling for — would be to divide Microsoft into several divisions. We could imagine that there would be several subsidiaries, each specialized in one sector: the first would be for operating systems; the second for applications; and the third for Internet activities. After all, Standard Oil was divided into 33 subsidiaries! This type of restructuring would in fact be good for the company: this would force its programmers to design, publish and use clear APIs among all of its programs. This means they would have to write better programs. This would also, obviously, force each of these products to develop market share based on its own merits, and not with the leverage of Windows.

Do you really think the courts will break Microsoft apart?

They don't need to split Microsoft into separate companies. Different divisions could have common stockholders, as long as they have separate management and especially as long as they don't exchange privileged information among them. This is what happened with IBM: at the time, Big Blue was supplying mainframe computers, along with its operating systems and applications. Competitors, such as Amdhal, were trying to sell the same type of machines to companies, but were selling them cheaper. IBM then modified its applications so they would not run on Amdhal computers. It was simple, since the interface between the program and the machine was secret. The 1985 ruling required IBM to separate its hardware, operating systems and software activities, to maintain open interfaces among the three entities, and to give the same information to its competitors as to its own subsidiaries. This was applied to the letter (note 7).

More generally, should the justice system be able to control technological sectors that are evolving at the speed of light?

Speed is a critical factor. In the computer industry, time is a question of life and death: it only takes six months to build a monopoly or kill off your competitors. If the justice system acts too late, some options are no longer available. It would be impossible, for example, to say that Windows 98 is illegal when it is installed on half of the personal computers in the world! This is why the Justice Department is trying to move ahead very quickly. They insisted that the trial begin in October 1998.

Microsoft, on the contrary, continued to request postponements, saying that it needed them to prepare for the trial, but it requested this to sell as many copies of Windows 98, with Internet Explorer, as possible before any rulings were made by the court. Even if the courts rule against Microsoft, it will be able to appeal before the Court of Appeals of the District of Columbia, which would probably not give its ruling before the spring of 1999. Then may come an appeal before the Supreme Court, which would decide sometime in 2000. By then, Microsoft will have already released Windows 2000, and any ruling that would be made would have the same insignificant effect as the 1995 Consent Decree!

Do you think that the European Commission should be involved in this question?

Yes, I do. It is easy to understand that American courts may be lenient with a company that brings a great deal of money into the United States. But Europe should act more independently and much more vigorously. While Microsoft makes 58% of its sales outside of the United States, most of the added value produced by the company returns there. In 1995, the European authorities that had carried out their own investigation merely reprimanded Microsoft for its behavior, without imposing any fines. Even worse: they merely copied the terms of the American Consent Decree, even down to the legal loopholes which allowed Microsoft to get around it. It seems that the European Commission has come to its senses since then, and is

carrying out a large-scale investigation into Microsoft's questionable practices. But everything here also depends on how fast the investigation goes, and powerful Microsoft's lobbyists are.

There is a proverb that says, "The trees don't reach the sky". Won't Microsoft's empire eventually crumble under its own weight, just like the Roman Empire did two thousand years ago, or more recently IBM?

I doubt it. It would be a mistake to say that giant companies like IBM, AT&T or Standard Oil lost power all on their own. The huge antitrust battles weakened these corporations. Microsoft uses methods that are very similar to those used by Standard Oil; this company constructed pipelines copying those made by its competitor, Tidewater, and then dropped its prices considerably to kill it off (note 8). I do not know of any example of a monopolistic company whose power eroded on its own.

But there is another important element: Microsoft's entire strategy is geared toward conquering its markets. Its goal is not to make good programs, but to make as much profit as possible and to control all the markets it is involved in: first, operating systems, then the applications used on them, then the Internet, then transactions over the Internet, then interactive television, etc. Microsoft's culture is entirely based on eradicating its competitors and maintaining its monopoly. Its product development is not dictated by a desire to anticipate the needs of consumers, but by financial logic: when should the next version of Windows be released to ensure a maximal amount of profit? Which market niche should they occupy to prevent Netscape or Sun Microsystems to find a weakness in their armor? IBM never shortened the development time necessary for any of its products merely to get them to market before a given deadline.

Do you not believe then in self-regulating market forces that suggest that competition in the marketplace will naturally bring about the best products at the best price?

No, because that does not correspond to reality. First, market economies do not encourage the development of the best products (see chapter 2). Second, competition is only efficient when the players are small and they all have limited power, that is, when there are no monopolies. Even the staunchest free market advocates are aware of this, and because of this, you find antimonopoly laws, such as the Sherman Act, even in the paradise of capitalism. But the champions of the free-market model, the big American corporations, are the first to break the rules of the market when they dominate a sector, and they have the means to capture consumers. They are aware that competition can be dangerous to their superiority and their ability to levy a monopolistic tax. In fact, it seems that Microsoft's objective is to be in a position to collect this tax, without even having to just sell products: to change from a business model where software is sold by the unit, to one where a levy is paid on the flow of information!

Isn't this mad race of the computer industry, where markets and trends are made and unmade in a couple of months, the best guarantee that an unexpected competitor may be able to destabilize

Microsoft? Microsoft's advocates cite the recent buyout of Netscape by AOL, together with their alliance with Sun, as a proof competition is vibrant in this industry...

Microsoft's argument, which says that "we are not a monopoly because Netscape was able to develop as much as they were", is totally ridiculous. Netscape's browser is not at all positioned in the same market as Windows, and it was therefore never a direct competitor to Microsoft. It was Microsoft who decided to become Netscape's competitor by buying the rights to the Mosaic browser from Spyglass, purchasing a program that later became Internet Explorer. This argument used by Microsoft is a good example of the company's real objectives: to have a monopoly, not only for operating systems for personal computers, or for applications, but over the entire world of information technology down to the tiniest niche.

Yes, it is true that this world moves very quickly. But Microsoft has often shown that it is able to follow these rhythms closely and redefine its strategy at each major change, taking advantage of every opportunity to extend its monopoly to new fields. So, no one can seriously predict if or how Microsoft will be overtaken by one of its competitors. Even more so, because, if it manages to dominate the Internet, it will have an unprecedented arsenal: a real "nuclear arsenal". We would then be entering a new world, whose economic laws have not yet been written. And Bill Gates is counting on both writing the rules and raking in the cash.

Chapter 2

Tales of Ordinary Madness

“ Where do you want to go today?” ask Microsoft's advertisements. The company tries to make people believe that its programs are at the cutting edge of technology. How much truth is there in this?

From this point of view, there are really two different types of people, with a huge gulf between them. On the one hand, there are people who know very little or nothing about computers, and who are easily fooled by Microsoft’s advertising campaigns that are almost subliminal advertising. On the other hand, you have knowledgeable computer users, that is, people who can look under the hood to see how its programs work. These people all agree that Microsoft programs are very poorly designed. If you look at the history of the company, this mediocrity has a logical explanation: as we saw earlier, the company is not at all reaching for excellence, but merely for the bottom line.

Let’s take a brief look at the development cycle for a computer program. The first thing software companies develop is a prototype. After the prototype has been touched up a little inside the company, they reach what is called the alpha version that is still too unstable to be shown to people outside the company. The next step is to correct as many bugs as possible to get to the beta version. This version of a program is usually given to a number of beta-testers, who work closely with the company, and help them by trying to find the remaining bugs in the program. After these bugs have been corrected, the final version is called the gold master, that is ready to be pressed on CD-Roms and sold to the public.

But Microsoft has often merely sold the beta version of its programs as finished products. Windows 3.0, for example, was almost unusable: it was necessary to constantly restart – or in computer jargon, reboot – your computer. It was also very difficult to print. So Microsoft corrected the bugs and released Windows 3.1 that its users naturally had to pay for. In this manner, Microsoft skillfully uses tens of millions of customers as beta-testers. And, in addition, they even have the nerve to make them pay for this “privilege”! This is continuing: the beta version of Windows 98, which was available last spring in some computer trade fairs, was actually sold for $30. This was the first time ever that a software company actually sold an unusable beta version of a program!

What bothers me, as a computer user, is that I constantly have to buy new products – and learn how to use them – to do more or less the same things. But this crazy headlong rush was not invented by Microsoft: it is characteristic of the entire computer industry.

This is not entirely true: there are software companies whose programs do not become obsolete as quickly as that. Programmed obsolescence has become one of Microsoft's specialties, because it is related to the company's hegemonic position. Software publishers have two ways to increase their sales and maintain growth for their profits: they either increase their market share, or, when the market is already saturated by its products (which is the case for Microsoft), they try and sell them more and more often to the same customers. To do this, they need to create new versions of their programs as often as possible. The new versions, which must look different, contain new functions, which are more often gadgets than useful additions, and Microsoft presents these as innovations. Even worse: to ensure that its users cannot get off the train, Microsoft holds their data hostage. This means that they simply have to buy the newest versions of their programs, even if they merely want to continue to exchange data with other people.

I know that, unfortunately, when talking about computers, people have been conditioned to think that it is a very interesting subject, but difficult to understand. Because of this, they give up trying to make their own opinions and trust the advice of the so-called experts, who are often merely just direct spokespersons for computer companies. Let us take a short trip to an imaginary world, that I attempted to explore in an article I wrote called "Cybersnare" (note 9). It is called the land of TechnoCretins, where a company, let's call it MacroPress, has slowly gained total control of all the print shops in the world. Publishers have them print their newspapers using proprietary MacroPress characters. One day, the company launches a large advertising campaign to explain that they have discovered new characters that are much more modern: let's call them Klingon characters, from the alphabet of the Klingon language, used in *Star Trek*. It starts printing all the newspapers and magazines in Klingon. Now, obviously, these characters can only be read using the MacroPress lens, which is sold at every newsstand, at the newspaper publishers' expense. The public is delighted by this wonderful technological innovation, and they adapt to the new characters and buy the lens.

Now that MacroPress has a monopoly, they change their characters every two years, and then, every year. The old lens cannot read the new Klingon characters, and each new version requires that the public buy new lenses at great expense. One of MacroPress' competitors sees an excellent opportunity: they invent a mini-lens, which is as efficient as the MacroPress lens for reading Klingon, and less expensive. But the publishers have an exclusive contract with MacroPress and refuse to distribute the lens. Even worse: MacroPress sues this competitor who is guilty of having reverse-engineered the Klingon characters to design its mini-lens!

Does it sound outrageous? Are you thinking, "Can this ever happen"?

Well, this is exactly what happens with Microsoft customers. There is no way to correctly read a document created with Word 7 using Word 5, for example. Serious problems can also be seen when trying to open a Word for Windows file using Word 6 for Macintosh. This is something I learned at my own expense, struggling one day to open a file that I downloaded from a site belonging to the European Commission. The result was that our laboratory had to buy a huge

PC with Windows 95 and Office, that we did not really need, just to be able to read these important documents. The Klingon lens is not as imaginary as you may think.

Microsoft Word users have to buy each new version of the program just to be able to continue to read files in the new format that come from other people. This constant evolution of products, which is presented as a sign of quality, is, in fact, a way to levy a monopolistic tax. Why should we have to buy a new version of a word processing program and learn how to use it every twelve or eighteen months, when people are still writing resumes and memos the same way they have for the past ten years? Even worse, if you purchased a complementary program for Word 5, for example a Spanish dictionary, you would need to buy it again to use under Word 6, since the old dictionary is incompatible, whereas the Spanish language has obviously not changed very much in recent months.

This is really just a way to kidnap your information. Because once you have entered your data into Word or Money, if you want to change the program you are using, it is very difficult to recuperate this work and transfer it to a different program. Microsoft has been very careful in not providing efficient converters to other formats.

It is also forbidden, according to American law, to reverse-engineer a Microsoft proprietary format, so a company who would want to sell a mini-lens converter would be guilty of Copyright violation (note 10). But we are talking about data that belong to the users. This certainly is the land of TechnoCretins!

Could you use plain words to explain exactly why you consider that Microsoft programs are technically deficient?

On Internet newsgroups and mailing lists, people who do not like Microsoft use names such as *crapware* and *bloatware* to describe its programs. I must admit, I find it difficult to contradict them. First, even novice computer users will notice that Microsoft programs are very large – this means they take up a great deal of space on your hard disk. This is not surprising since there are all sorts of gadgets hidden inside them: some clever people discovered that an improbable series of commands (note 11) made under Excel 7 would launch a flight simulator that shows you the names of the programers! There are other surprises like this, called Easter eggs, such as a pinball machine in Word 7…

But seriously, each time Microsoft releases a new version of a program, it is larger and slower. This deterioration began with Word 3 (written with the C programming language), that ran much slower than the previous version (which was written in assembler). On the face of it, this loss in speed should be an acceptable trade-off for the advantages of the program being written with a higher level language. But this sad state of affairs has continued since then, even when the programming language, that could justify a loss of speed, does not change. We have now reached a point where the user needs much more memory today to make Microsoft products run correctly than to install a traditional Unix server, which includes thousands of sophisticated programs.

This leads me to present a simple statement that is often ignored: a sophisticated system, developed with a respect for quality, will require a fairly large amount of memory, but these requirements will not increase greatly as new versions are released. However, a system whose original name gives an idea of how it was constructed (Quick and Dirty Operating System), and that was purchased from another company and touched up quickly, is inevitably destined to become much more ponderous as Microsoft adds more and more layers of essential functions that were not planned at the beginning.

Elegance and economy can only be obtained if the correct architecture is planned from the very beginning. Unfortunately, in a world of financial imperatives, existing programs are never completely rewritten. Companies merely improve them by adding new layers of code, which increase their size and decrease their speed. Because of this, as Microsoft executives have admitted, the Windows 95 source code contains more than 10 million lines… This is for the operating system alone, and does not even count its additional applications. When you think that the federal aviation administration had to abandon an air traffic control program reorganization project, because it was too large and contained 2 million lines of code (note 12), it is not surprising that you often have to restart a computer using Microsoft bloatware!

This explains why we are now in the situation where we must throw away a huge number of computers that function correctly, but are not powerful enough to run Windows. These same computers could be used as efficient servers to run one of the many flavors of Unix on a PC. This is also why Intel can sell millions of chips as soon as it releases a new, faster model: people who use Microsoft programs need more and more power to make their computers run at a decent speed. Let us not forget that the first IBM PCs (using the Intel 8088 chip) ran at a clock frequency of 4.77 MHz. Today's Intel Pentium II processors run at 400 MHz. But almost fifteen years later, Microsoft Word does not run a hundred times faster than it did before. If these new programs are larger, it is to add new functions for users, claims Microsoft. But studies have shown that most of these functions are used little, if at all. So why should we sacrifice money and speed for something we do not use?

Other than the question of the size of these programs, are Microsoft programs well-designed?

Absolutely not. Here is one example: since the very beginning, since MS-DOS, Microsoft has used an obsolete file management system. If you use Windows, you have definitely heard about the program called DeFrag. When you run the program, your computer displays lots of little different-colored squares that move all around as your hard disk does some serious work. Microsoft's explanation for this is that the more you use your computer, the more your disk gets fragmented, and the slower your computer runs. So, to correct this problem, you should use DeFrag regularly, which will "defragment" your hard disk so it runs more quickly. Really? Why do computers using Linux, FreeBSD, or any other type of Unix not have this problem? With this kind of computer, under normal conditions, the hard disk is never more than lightly fragmented, and the more you use it, the less it fragments.

You see, these systems operate much differently than Windows. To use a familiar metaphor, imagine that your hard disk is the Internal Revenue Service. And that your files, saved on the disk, correspond to files that civil servants store in a huge file cabinet, containing millions of tiny drawers. Now, it is clear that if you are looking for an entire file – the one concerning Microsoft, for example – it would be much easier if all of the documents making up this file were in contiguous drawers, rather than spread out all around the file cabinet. When dealing with data it is the same: it is easier to have access to the data you want if it is organized in contiguous files, rather than spread out or "fragmented".

The problem is therefore to make sure that this file cabinet is properly organized each time you finish using it. And what does Windows do? It acts like an inexperienced file clerk: when a job has been finished and its file is not needed anymore, it throws its objects into the trash. And when you give it some documents you want to use to create a new file, it separates them into tiny groups that it files at random in the first empty drawers it finds. Well, with this type of system, you have to ask for a budget increase to hire a team of interns (DeFrag) to work every weekend to try and reorganize the file cabinet. Linux, however, works like an experienced file clerk: when you ask it to throw away old files, it systematically creates a list of the drawers that are now empty. When filing a new file, it looks in this list for a series of contiguous empty drawers that are large enough to contain the file. I'm sure you will agree with me that no office manager would be crazy enough to hire the first file clerk, who would cost him more and is inefficient, instead of the second, who works almost for free and is much more efficient. But this is what happens every day when people choose Windows.

To sum up, Microsoft's commercial propaganda bamboozles its customers by telling them that DeFrag makes their computer runs faster… whereas it is really Windows that is slowing it down! Microsoft is powerful enough to be able to distort reality in this way. It turns its programs' weaknesses into indispensable assets. In the computer industry, there has long been an ironic expression that is used when this type of weakness is discovered: it's not a bug, it's a feature!

But aren't these disadvantages due to the need for compatibility with much older software layers? In other words, doesn't Microsoft's heritage, which is its huge installed base, impose complicated program architectures?

I think this story of compatibility is nothing but an excuse. Even in the DOS-Windows world, there exist better-designed programs. (Look at Novell's file servers, for example). It is not technically impossible to create a file management system from the mediocre heritage of MS-DOS that could function correctly. You only need to use DeFrag because the file allocation system under Windows is badly written. The other major problem with Microsoft programs is that the operating system is extremely vulnerable to user errors. Take, for example, ScanDisk, a Microsoft program included with Windows, whose job is to repair damage to your hard disk. Well, it offers many incomprehensible choices, most of which users, even computer specialists, do not understand. But if you make one wrong choice – a Yes instead of a No – the procedure

could simply destroy the structure of your files. Whereas, most of the time, your data was probably still recoverable before running ScanDisk.

Strictly speaking, Windows users play with fire each time they install or uninstall a new program on their computers. Here is a telling example: a story told by Steve Cohen, an American computer programmer, who firmly believed in Windows up until this point. Steve's son had been badgering him to buy the latest version of a baseball game for his computer. The boy was conscientious, and he launched the uninstallation program for the old version of the game under Windows 95, before going to the computer store to buy the new program. When he came back, he had a terrible surprise – the computer was completely frozen. It was impossible to reboot it. Steve called the computer manufacturer, Gateway. After an entire day of dealing with this nightmare, the only thing he was able to do with his computer was to reboot under DOS, because Windows would just not start up. Steve, who publishes a newsletter, noticed at this point that all of the data that he had saved on his hard disk was broken into little bits, with strange names containing tildes (~). This is because DOS can only handle files whose names contain 8 characters, plus a 3-character file extension. There is a possibility under Windows 95 of using long file names, but this is only used through a software layer that is not available under DOS, not even the MS-DOS which is at the heart of Windows! It was impossible for Steve to sort out his files under DOS, and to find out which of the files named BULLET~1 and BULLET~2 was the correct "BulletinJune1997", for example. Steve Cohen finally had to completely reinstall Windows, and was incredibly frustrated by this.

This anecdote is just one of the problems that Windows users come across regularly, and it shows that the integrity of our data is at risk on Wintel computers. This is just another example of everyday madness in the world of Microsoft. A world where, to install a CD-Rom designed for the general public, the user has to answer questions such as: "A file being copied is older than the file currently on your computer. It is recommended that you keep your existing file. Do you want to keep this file?" Yes? No? How should I know? Even I, a computer scientist, haven't the slightest idea. So how should novice computer users know? Windows users all discover one day, at their expense, that the beautiful graphical interface that they see when they light up their computer is merely a superficial layer of the program, built on top of a prehistoric architecture called DOS. And the DOS-Windows couple ignores even the basic rules of good behavior for operating systems, which are taught in all the computer departments in all the universities of the world.

But this story of everyday madness had an extraordinary, even revolutionary punch line: Steve Cohen did not, for one minute, accept that he was responsible for this problem. He felt that it was unacceptable that the simple fact of uninstalling a program should require him to reinstall his entire operating system, and risk loosing all his data. He considered that in this case the fault lay with Windows, and not to the individual user who had not backed up his data recently. Steve then decided to make some room on his hard disk to also install the Linux operating system, which is not very well known, but which does not have these disadvantages. Because under Linux, each user can only access their own data. Users are not expected to – and, in fact, cannot

– touch files belonging to other users, and especially not the operating system, that is well protected against user errors (see chapter 5).

But it should be easy to change the design of operating systems, in order to protect the sensitive parts of the program…

Of course. But this possibility of modifying operating system components is not so accidental. Microsoft's competitors even go as far as suggesting that the company regularly does this to sabotage their products (see chapter 3). Other than the chance of inadvertently damaging your computer, this vulnerability of the computer's vital organs means that it is susceptible to all kinds of danger, starting with viruses.

Do you mean that computers running Microsoft operating systems are more vulnerable than others to computer viruses?

Without a doubt. It is true that Unix computers are occasionally victims of viruses, but these viruses can only access files where I, as the user, have write permission, and not data that belongs to my family or my colleagues that also use the machine. In no way can viruses access the applications or sensitive components of the operating system. So, unless there are loopholes in the system that have not yet been detected, these viruses cannot cause too much damage. And when security flaws are discovered in the Unix world, they are quickly corrected. Because of this, it is not as fun for hackers to create new viruses for Unix.

On the other hand, in the DOS/Windows world, as well as in the Macintosh world, viruses are just another type of program. They do not take advantage of bugs, they simply work on the principle that anyone, including themselves, can manipulate the operating system. They can therefore modify the system, in such a way that one of your actions, for example opening a file, may cause thirty-six copies to be made of that file. In addition, they may cause irremediable damage to the system: your data may be modified, your applications' operations may be affected, your entire hard disk may be erased, etc.

But there is something even worse: with the latest generation of Microsoft Office programs – Excel 6 and 7, Word 6, 7 and 8 – a new type of virus has appeared, called macroviruses. These extremely dangerous viruses have made it much easier for people who write viruses, and made it much harder for average users to even imagine that viruses may be present. Documents created by these programs may include small bits of programming code called "macros", written in VisualBasic (an evolution of Microsoft Basic). Now, this may be very useful, as a way of telling your computer to automate repetitive tasks: for example, open or close all of its windows. But the problem is that these programs also contain commands that can modify, move, and even erase your files. All that is needed is to put a small bit of macro-programming in a Word document (that no one would really assume can even contain a program) that sends a command each time you open this document to – why not? – erase your hard disk! In addition, this macro-language is the same for all versions of Office, both on PCs and Macintoshes. So, it is now possible to transfer viruses to machines on a different platform, which was very difficult

before. What an extraordinary innovation! With VisualBasic, Microsoft has created a standard virus platform. But already, in 1992, Professor Harold Highland warned of the dangers of viruses that could be written using powerful macro languages.

At the Sorbonne University in Paris, a literature class currently working on a collective text, where a large number of students and authors outside the university participate, discovered this the hard way. The teachers managing this project distributed disks containing files in Word format to all the contributors, who are working with many different types of computers. One of the participants in the project caught a macrovirus that randomly inverted the order of words in a text. You can imagine the results that this could have for literary texts. He contaminated everyone else working on the project. One of the participants lost all the data on his hard disk. And, even now, no one has yet discovered the way to completely eliminate this sophisticated "creature", which makes it impossible to save your files in any format other than Word.

While viruses used to be difficult to write using assembler programming language, it is now very simple: all you need to do is click, using the user-friendly tools provided to edit macros. You can even buy macro virus development kits over the Internet (sorry, we won't give you the URL for this!). You can create your own virus, and send it to other people embedded in a Word document attached to an e-mail message. And in just a few days, you could contaminate thousands of people like this!

But you cannot expect Microsoft to stop releasing new products, just because malicious kids spend their time writing viruses!

Don't get me wrong. For classical viruses (such as boot viruses) some computer experts have already pointed out these serious security problems to Microsoft. Padgett Peterson, an American virus specialist, even went as far as suggesting simple solutions to Microsoft, that would only require minor modifications to its programs: a few lines of code would be changed and the doors could be closed. But Microsoft never reacted. As if the fight against viruses was the least of its worries! This is, in fact, what some of Microsoft managers have suggested off the record: Windows 95 is an operating system for the general public. A program written for "housewives under 50", to use an analogy from the world of television, and, after all, this type of public does not do very much with their computers: it does not matter if they waste their time rebooting their computer and catching viruses. As for serious computer users, they must now buy the professional version of Microsoft's operating system: Windows NT (which does not protect you very much against macroviruses either, but they will not tell you that).

If viruses can get in, so can hackers…

The design deficiencies of Microsoft products are open doors for those who wish to take advantage of them. And the problem is even more serious, as each of us entrusts an increasing part of our private lives to computer networks. There was a recent demonstration, in Germany, of the far-reaching implications concerning security flaws related to ActiveX, a Microsoft proprietary technology. Online banking is very popular in Germany. The Chaos Computer Club

of Hamburg proved that ActiveX made it easy to steal money from people who use online financial management programs (Quicken or Microsoft Money), on a Windows PC using the Internet Explorer browser (note 14).

Let's take a close look at this interesting story. In order to combat Java – a programming language that makes it possible to run applications on any type of computer, even without using Microsoft programs – Microsoft invented another language, called ActiveX, designed to communicate specifically among Microsoft products. This language makes it possible to directly launch Windows applications and exchange information among them. In this way, only Windows and Internet Explorer users can fully use the features of Web sites using ActiveX.

The problem is that by continuing with this monopolistic strategy, Microsoft completely neglected the security of its users' data: while Java ensures that applications downloaded by clicking on Web pages be limited in their actions, ActiveX opens all the doors. Web surfers are far from imagining that by clicking on an icon on a Web page, they authorize their computer to give commands without their knowing. The little devils in Hamburg showed that it was quite simple for a swindler to design a Web page that could use ActiveX to become a no-armed bandit.

How does this work? It's actually quite simple: you browse the Web using Internet Explorer, the only browser that supports ActiveX. You come across an attractive page with a banner advertisement saying "Become a millionaire in five minutes! Click here!" So, you click… A few seconds later, a message informs you that an ActiveX applet is being installed on your computer. You then see some nice graphics, which tell you that, unfortunately, you did not win the big prize this time. But in the meantime, you have helped someone else hit the jackpot, because the ActiveX commands contained in the Web page launched Quicken (as a background task, in other words, invisibly) and gave the order to wire some money to a hacker's account, registered under a false name.

A few days later, when you connect to your online banking service, with your password, the order that was pre-programmed by the ActiveX application is sent to your bank, and certified by you. When you receive your next bank statement you might not even notice this small wire transfer, or you might think of something else that you bought that you may have forgotten about: after all, who could have gotten into your house and manipulated the data on your computer using your password?

Microsoft did its best to play down this demonstration, but not to correct the flaws that it brought to light. ActiveX definitely opens major loopholes in the security of Internet Explorer, whereas other browsers such as Netscape Navigator or Opera do not support ActiveX and do not have this same flaw.

Microsoft's choices are usually justified by the guarantee inherent in its brand name and reputation. Is this legitimate?

Absolutely not. And that is the saddest thing of all. The general public cannot judge the quality of these programs, they can only trust advertising, computer magazines and, finally, a brand. When Bill Gates goes to Davos, Washington or Paris, and is seen hobnobbing with presidents of other multinational corporations, ministers, and heads of state, the general public trusts his brand. They think they can have faith in the solidity of the world's leading publisher of software for personal computers, that it must certainly be able to guarantee the quality of its products. But this guarantee is really quite minimal, as we can see in the Windows user's manual. Until Windows 95 was released, there was no guarantee at all. Today, the Windows 95 or Windows 98 license text only guarantees that "The PC manufacturer warrants that the software will perform substantially in accordance with the accompanying written materials". But they accept absolutely no responsibility for "any damages whatsoever". If any accidents occur, no damages are guaranteed, whether for personal injury, loss of business profits, business interruption, loss of business information or any other pecuniary loss arising out of the use of or inability to use this product or hardware…

I will certainly agree that one cannot expect there to be "zero faults" with complex systems such as computer programs. But we can at least expect that the world's leading computer software publisher ensure that its programs be designed correctly. This means that they should include certain techniques that have been well known for quite some time, such as, for example, an efficient file management system. After all, we expect electricians and plumbers to conform to generally accepted practices. Why shouldn't a multinational corporation with $3.45 billion in annual profits do the same?

Microsoft users point out that the company is far from number one as far as technical support is concerned.

When you buy a computer from a leading brand, you can read the following text in the Windows license:

6. PRODUCT SUPPORT. *Neither Microsoft Corporation nor its affiliates offer support for the* SOFTWARE PRODUCTS. *For support please contact the support number of the computer manufacturer included in the documentation of the* COMPUTER.

This is an interesting way for Microsoft to pass all the headaches – and, of course, the huge costs – of supporting its products onto computer manufacturers. The company can do this because Windows is preinstalled on most computers by these manufacturers. The problem is that companies such as Compaq, Gateway, HP, IBM or Dell are not responsible for problems with Microsoft products, and they cannot correct them. So, instead of supplying quality technical support for their own products, their hot lines are often tied up with questions by novice users who are facing the sad reality of a world under Windows. Sometimes they even forget that anything else exists: at the École normale supérieure, where I teach, we spent a great deal of time fighting with Hewlett Packard technical support who tried to claim that the problem with one of our printers was with a "new Windows driver", while no one uses Windows in the

school! Many users end up high and dry, without getting solutions to their problems. Or, even worse, they play ping-pong among the different hot lines of their suppliers.

You are only actually allowed to request customer support from Microsoft if you have purchased the program separately, in other words, if it was not pre-installed on your computer (which will cost you at least twice as much). And, even then, the support you get is more in name than in deed. It was almost impossible in July 1998 for American users of Windows 98 to get through to the free customer support line, but it was very easy to get through to the paid customer service line, which costs $35 per "incident" (note 15).

Has Microsoft's professional operating system, Windows NT, solved these problems of quality, safety and security that you have mentioned?

Microsoft's weapon to penetrate the corporate computing market certainly has some advanced functions. The Windows NT operating system for workstations and servers can protect files, and does use the idea of different user names with different permissions, as with Unix. The system components are fairly well protected. This explains why the product managed to receive C2 certification, which is a guarantee of a high level of security. But this is only true when the program is examined on its own, with no applications installed and no network connection. This seems a strange kind of test for a server, doesn't it?

The key question is not the security of the operating system itself, but whether the client-server programs together are designed with quality and security in mind. An American computer security consultant, Mark Edwards, pointed out, at the end of July 1998, that Windows NT 4.0 had a very serious security loophole. Any network user could effectively manage the network under Windows NT (change passwords, change permissions to confidential areas, etc.) as if he were the administrator! Microsoft quickly wrote a patch and made it available to its customers (note 16).

Unlike IBM or Sun, Microsoft is not a company with a culture of computer networking. Because of this, it is struggling to adapt its tools to a world that requires a high level of security. This cultural heritage poses very serious problems when Microsoft attempts to introduce Windows NT into sectors where the reliability of computer systems is critical: banking, process control, automatic telephone switches, satellite positioning systems, or software used on airplanes, space shuttles or cars. It would be unacceptable to have to reboot an air traffic control computer, or a financial market trading room system!

These applications, which are vital for the companies that use them, run today on computers made by IBM, Digital Equipment, Hewlett Packard or Sun, and often run under Unix. Personal computers, whose calculating power has grown enormously in recent years, can certainly replace large systems for some non-strategic needs. But what is critical, in the business world, is not calculation speed but computer reliability: crashes are not accepted. And Microsoft has no credibility in this respect.

But didn't the US Army choose Microsoft Windows NT for its latest computer system?

It does seem quite disturbing that people responsible for strategic decisions, such as the choice of an operating system that will be used for weapons systems or space probes, blatantly ignore recommendations from their own experts, and fall for specious sales pitches. Especially because these brass hats have already discovered the consequences of abandoning a high quality open technology for Windows. An official report from the US government (note 17) describes an incident that occurred on the US Navy's "intelligent boat" equipped with Windows NT. The boat got stuck when the system crashed, and had to be towed back to port, according to Anthony DiGiorgio, a civilian engineer working for the Navy. To justify the choice of Windows NT for this ship, a certain Mr. Redman, of the Navy, explained: "Although Unix is more reliable, NT may become more reliable with time"!

It is unfortunate that this type of story does not make the evening news, whereas Bill Gates is shown traipsing from city to city with Leonardo da Vinci's Leicester Codex, an original manuscript that he purchased and lends to exhibits.

We have seen that the MS-DOS operating system, which made Microsoft's fortune, was not designed in-house. Has Microsoft created any of its other programs on its own?

The programs that people speak most about right now were all purchased by Microsoft, who then adapted them to its needs. We have seen how MS-DOS was originally purchased from Seattle Computer. But the Windows layer itself, a bad copy of the Macintosh graphical interface, is "made in Microsoft". The Internet Explorer browser – as is specified in its copyright notice – is derived from the NCSA Mosaic browser, that Microsoft purchased a license for from a small company named Spyglass. Windows NT, which has nothing in common with Windows except for its name, was designed by Dave Cutler, a programmer hired to write this program, who had previously worked for Digital Equipment (where he designed, among other programs, the VMS system).

But Microsoft has done the development for its Word and Excel programs, after seeing the success of previous programs such as Wordstar or Lotus 1-2-3. The company also, as time went on, added functions (spell checker, grammar checker) that were originally sold as complementary products by some small companies. This has become one of its key strategies: since Microsoft programs are so poorly designed, start-ups have the possibility to invent programs which complement or correct their functions. One example is Stacker, by Stac Electronics, that compresses your hard disk to effectively make it twice as large. Another is Quarterdeck, that allows you to run multiple tasks under DOS. For a while, these small entrepreneurs can make some money. And then, one day, if their product works well, Microsoft purchases a license to use it, or just shamelessly copies it and integrates it into a new version of one of its products. According to some of these companies, Microsoft even goes as far as modifying its system so the original program will no longer work, or will work less efficiently than the Microsoft copy (see chapter 3).

It seems difficult to imagine that Microsoft, with thousands of programmers working for it, does not have an autonomous research and development department.

The company does employ thousands of programmers, who develop or adapt its programs. But when there is a program or a technology for a given market segment that it considers important, it is quicker for them to just purchase the know-how. Hardly a month goes by without Microsoft buying one or two cutting edge companies.

Not one single software innovation has come from Microsoft. Up until 1995, the company did not even have a research division worthy of this name. Its managers did not see the usefulness of maintaining a laboratory, such as the Xerox Parc laboratory or HP Laboratories, to sell software for personal computers. This has only changed over the last three years, with the rising importance of the Internet, and Microsoft's ambitions to dominate the corporate computing sector. There is a Microsoft Research department in Redmond and another in Cambridge, England. But, for now, these Laboratories function only as showcases (see chapter 4).

If, as you have pointed out, the community of computer experts thinks that Microsoft products are so bad, why haven't these people spoken out before?

There are many computer specialists who have the knowledge necessary to see through the smoke and mirrors and point out the errors, dangers, and manipulations, without running the risk of being criticized as jealous competitors. But these people have been quiet for too long. It is true that this vacuum has been filled by pseudo-experts, who mostly churn out disinformation. I think there are a number of reasons for this, and not all of them are glorious. First of all, we have to understand that if a scientist tries to reach out to the general public, he must accept to use media that he does not necessarily respect, such as the computer press, whose content is often nothing more than documentary advertising.

This is one reason why serious experts do not write articles in this type of magazine, because they are afraid that their reputation may be marred by this association with snake oil salesmen. Unfortunately, this has contributed to a vicious circle: since the experts ignore them, and since they depend mostly on their advertising, computer magazines are often no more than a mirror for the propaganda fed to them by hardware and software manufacturers. This increases the commercial aspect of these magazines, and makes them even less respectable. Also, the pseudo-experts who have established themselves there do not necessarily want this to change.

But the situation is changing. Serious journalists, concerned about cutting through the propaganda of hardware and software companies, are starting to pay more attention to knowledgeable scientists. And these scientists are now more apt to speak out, because, with Microsoft's current legal problems in the United States, they can hope that their critical comments may have a certain amount of influence.

To be totally honest, I also think that the computer community is not very worried about Microsoft deceiving the general public, that they look on with a certain amount of

condescension. "There is no point in telling these people the truth", say the researchers, "if we don't explain things in detail, they won't believe us; and if we do explain things in detail, they won't understand it". Unlike what happens in other sciences, such as physics or mathematics, no important computer researcher has really tried to vulgarize the field.

Above all, up until now, the community of computer researchers has managed to more or less avoid personal computers and Microsoft. These people could afford to be totally indifferent. But this is no longer the case. There is a risk that we may all end up with PCs on our desks. And especially because Microsoft is now trying to take control of the Internet, which is the researchers' main means of communication: in a way, it is "our" network.

Bill Gates' classic defense is that consumers like his products. If Microsoft products are so bad, how have they managed to convince the whole planet?

First, because markets are not perfect systems. In the world as we know it, the best products rarely win. Why? Because making an excellent product – and this is even truer for software – requires a huge amount of time and money. But in all sectors of the economy, and especially for technological goods, the early bird catches the worm. It is therefore better, commercially, to outstrip your competitor and fill a niche with a mediocre product, that you can improve gradually. And a company that sells sturdy, high quality products would find it difficult to convince its customers to change them every year! So, in all sectors, we are seeing products designed to last shorter periods of time, and with a shorter manufacturing cycle.

In addition, the intrinsic quality of these products is becoming a secondary factor in their success, that is related to other criteria: marketing know-how, distributing power, and, of course, compatibility with existing applications. You may remember Sony's Betamax format that was killed in a few months at the beginning of the nineteen-eighties by its competitors' VHS, because more films were available in this format. People were obviously not buying VCRs for their technological capacities, but to watch movies. In the same way, computer users do not buy operating systems for the elegance of their architecture, but to run a certain number of useful applications. Windows' main strength today is that tens of thousands of computer software publishers have created applications that run under this system.

On this subject, we could talk of a "network effect" or a "domino effect". Now that computer networks are the norm, programs can no longer exist on their own. For any of them to be usable, they must be able to work correctly with other computer programs – that is, they must be "interoperable". This is a specific characteristic of the computer world. In a kitchen, no matter which kind of tomatoes you use to make tomato sauce, you can use any kind of food processor. However, your word processor must be able to run under a given operating system, that must be able to run on your computer. And it must be possible to send these text files to someone else, who must be able to read them. Since there are no open standards for word processing files, the choice of a word processing program is not as free as one may think. If a company wants all of its employees to be interoperable, it is almost required to choose the dominant standard. All these things are interconnected. The software publisher who, like Microsoft, controls the central

link in this chain – the operating system – is naturally in a position to influence purchasing decisions for all the rest of the chain. We will see how Microsoft is exploiting this advantage as much as possible, by integrating its programs together (see chapter 3).

Another factor helping the dissemination of Microsoft products comes from the pyramid structure that influences decisions in companies. At the highest level, managers are like politicians: they have no more than ten minutes for each decision. Usually, they do not even know much about the question and don't listen to the technicians who do know about it. These CEOs basically tell their computer managers: "Make the right choice". And these computer managers choose Microsoft, to protect themselves. Because you will never be criticized if you have chosen software made by the company that controls 90% of the market. But that does not mean that the end users have chosen Windows: it has been imposed upon them. And if they are not entirely satisfied with this choice, this is not serious either: Microsoft explains that, in any case, there will soon be a better version of the product!

This type of decision-making process can lead to strange results. NASA's Johnson Space Center threw away thousands of Macintosh computers, and replaced them with PCs running Windows 95, in June 1995, one month before the latest version of this operating system was released! This decision was made by the Chief Information Officer, without consulting or analyzing cost-effectiveness compared to other solutions (note 18). A similar situation occurred with Exchange and Windows NT. Since this concerns the taxpayers' money, the US Congress opened an investigation.

I think that as the portion of budgets relative to computers increases in small companies, these companies will become more aware of their needs. Small businesses need strong stable terminals, dedicated to certain tasks, that can be purchased for half the price of PCs running Pentium II and Windows 98.

3

The Ivy Tactic

Bill Gates presents himself as the voice of competition. But you explain that Microsoft actually uses every means at its disposal to eliminate its competitors. Can you describe the methods you accuse this company of using more precisely?

Microsoft's public statements totally contradict the company's practices. On the one hand, Microsoft says, "our software is the best, because the public buys it." On the other hand, it uses a very sophisticated arsenal of techniques to prevent the public from choosing anything other than its products. This shows that the leaders of this company do not believe at all in the quality of its programs. When you look at Microsoft's conquests and practices, individually, this all looks very banal. It is a bit like a game of chess, where, if you only watched a few moves out of context, you would see a pawn being taken, a knight put in check, a rook advancing… nothing spectacular. But when you step back, and look at all of Microsoft's strategies in all the battles it has fought — and won — you start to see a chronicle of a monopolistic conquest. Let's look at the practices themselves. Microsoft uses several types of weapons to annihilate its competitors. The most common and best-known of these weapons are its commercial tactics, beginning with the inequitable contracts that it imposes on computer manufacturers.

What exactly are the relationships between Microsoft and the companies that sell computers, such as Compaq, Dell or Gateway?

Microsoft tries to force the large computer manufacturers to offer only its products. This practice dates back to the very beginnings of the company. In fact, up until 1995, Microsoft required that all distributors of IBM and IBM-compatible PCs pre-install its programs on every computer they sold: first this was MS-DOS, and later Windows. The type of confidential contract that it signed with these manufacturers involved a license fee "per processor". It was written in black and white that IBM or Compaq had to pay a set fee for every computer they manufactured and sold, whether or not the end user wanted to have DOS or Windows installed on the computer. We can see that it was in the distributor's best interest to install Windows rather than something else that would cost them more. As for the end user, there was no point in them asking to have DOS or Windows uninstalled, because, in any case, they had paid for it. This is called an abuse of dominant position, which is harmful to all of Microsoft's competitors. A customer who wanted to buy Digital Research's DR-DOS (which was later purchased by Novell, and finally by Caldera), for example, would still have to pay for MS-DOS.

So, the general public was "free" to choose a Microsoft product, or to pay twice for their operating system! This practice was criticized by the Justice Department, and also by the

European Community. But nothing concrete came out of this. After years of legal procedures, a settlement was reached which resulted in the 1995 Consent Decree, where Microsoft agreed to… nothing at all. As we saw in chapter 1, not only did Microsoft have no fines to pay for its many years of illegal activities, but it was also able to get around these fetters by developing a new practice had exactly the same effects. Instead of forcing computer manufacturers to sign license contracts "per processor", they now had the choice between a license "per model" and a license "per copy".

In the first case, the manufacturer agreed to install Windows, that they paid very little for, on an entire product line (a given model of a computer), that the end user could not purchase without Windows. In the second case, the manufacturer only purchases licenses corresponding to the actual number of units ordered by its customers. But in this case they have to pay two to three times as much for each copy of Windows! On the surface, computer manufacturers have a choice and the Consent Decree was respected. But we should also note that the European version of this agreement (note 19) explicitly specifies that a license "by model" would be illegal if all of a manufacturer's models had to be included under this type of license. But, when it comes down to it, computer manufacturers systematically choose the first option, by model, for all of their computers sold to the general public. And end users still have no freedom of choice, exactly like before.

Even worse: if you wish to purchase a new computer, and you already have Windows (this is a typical situation for most companies who are renewing their computer equipment), these large manufacturers will not let you purchase new computers without Windows.

Do you mean that a user cannot buy a PC today without Windows?

This is actually impossible; unless you find a small computer store that will put together a computer for you piece by piece. But if that happens, you had better know how to open the hood in case you have any problems. What this means is that if you buy your computer in a large chain store, there is no way you can avoid Windows. You have the same lack of choice as a company if you are looking for a distributor to sign a maintenance contract where your computers will be repaired in less than 48 hours. A student at the Center for American Public Policy and Politics of UCLA, David Chun, made a survey in June 1998. He contacted the twelve leading computer manufacturers, including Gateway, Dell, Micron, IBM, Packard Bell, Hewlett-Packard, Toshiba, NEC, Sony, Unicent, Umax and Quantex and asked them the same simple questions:

1. Do you offer any other operating systems?

2. Can I buy computers, any models, without buying Windows?

3. If not, why?

4. Can I return Windows and get a refund?

Chun's conclusions are very clear: "Of the twelve OEMs (original equipment manufacturers) contacted, none would sell a computer without Microsoft Windows, and none would offer a discount if I returned Windows and asked for a refund"! (note 20) Most of these manufacturers explained to David Chun that "their contract with Microsoft required that they sell Windows with each computer". The funniest of all was that IBM, who created OS/2, an operating system which is one of Windows' competitors, requires that its customers purchase their computers with a license for Windows… even if they make it very clear that they only want to use IBM's OS/2!

Why don't computer manufacturers, who are powerful companies, rebel against Microsoft's "diktats"?

It is important to point out that, in recent years, computer manufacturers have not had very high profit margins. Most of the profits made in the computer business is made on software, because there is almost no manufacturing cost. Once a program has been made, with costs that may be relatively large, it can be duplicated on a CD-Rom for less than a dollar per copy, or even be downloaded over the Internet, and, in this case, it is the user who pays to download it. Hardware has fixed costs, and these costs lower only a small amount as the volume of sales increases. Profit margins on hardware sales are very small because of this. For this type of market, competitors fight it out with daggers drawn: manufacturers struggle to save a few dollars here and there on their price.

It is therefore obvious that no computer manufacturer would take the risk to be the only one to pay its licenses for Windows, Office or any other software, even ten or twenty dollars more than its competitors. Because Microsoft could very easily, in retaliation, refuse to sell "per model" licenses at reduced cost to manufacturers who are trying to be too independent. A manufacturer who would have to pay the "per copy" license on more than half its sales would probably go bankrupt!

These huge computer companies that look so strong, are really built on shaky foundations. They are merely puppets, and their strings are pulled by the real bosses in this industry: Microsoft, and in a lesser manner, Intel.

This is also why computer manufacturers accept to pay the huge cost for technical support by telephone, that should be the Microsoft's responsibility, as we have seen in chapter 2. But Microsoft does not twist the arms of just hardware manufacturers: it has a very good reputation for using its coercive power and aggressive marketing strategies on all the links of the distribution chain, down to the end user.

Can you give some examples of these aggressive marketing techniques?

Microsoft sometimes takes its customers hostage by forcing them to buy a product they don't want in order to get a program they do want. In Japan, for example, Microsoft's Excel

spreadsheet program is very popular, but Japanese people do not like its word processor, Word, which is not very well adapted to Kanji characters. The problem was that, up until recently, Excel was only sold in its Office suite, which also includes Word. This means that Japanese users who wanted to purchase Excel also had to buy Word, even if they just threw it away (note 22). Microsoft only stopped this after the Japanese Federal Trade Commission began investigating these practices.

Another questionable Microsoft tactic is to use the "sheriff" of the profession — the Business Software Alliance (BSA) — to put pressure on companies who make illegal copies of software. Notice that I do not like and do not use the word "pirated", because of its connotations of blood-thirsty thieves that have nothing to do with the world of software. But listen to this incredible story: one fine day in 1995, representatives of the BSA discovered a certain number of irregularities at the Uruguayan telephone company Antel. This company had installed many more copies of Novell and Microsoft programs that they had officially purchased licenses for. Companies must buy one license for each computer, but they rarely do this, especially in developing countries. Lawyers from the BSA filed suit for $100,000, in damages. So far, this is a normal story. But in 1997, the suit was dropped, because of an "out-of-court settlement" between Microsoft (who was not the only plaintiff represented by the BSA) and Antel, according to the following agreement: the BSA would forget everything… as long as Antel replaced all its software (including the Novell programs; and Novell was one of the plaintiffs) by Microsoft products! This story was presented by Rachel Burstein in the January 1998 issue of the Mother Jones magazine. (note 22b) Representatives from Microsoft and the BSA quickly denied the entire story. But if it was not true, then why did Lotus and Novell publicly announce that they would no longer use the BSA's "services" in Latin America? Burstein's article highlights something that is far from an isolated incident: the BSA is so closely tied to Microsoft that some of its competitors have left to join the Software Publishers Association. This organization, which is more influential than the BSA, has recently strongly criticized Microsoft (even though Microsoft is also a member of this association) (note 23).

Others in the computer industry also suspect Microsoft of threatening retaliation against some of its partners that have tried to be too independent. It seems that some of the players in the hardware business — especially card manufacturers like Xircom, but also other chip and computer manufacturers — have refused to give the technical specifications for their hardware to Linux developers, who would like to make sure that this operating system be compatible with as many hardware components as possible. This means that these companies are deliberately cutting themselves off from 8 million Linux users. Is this in their interest? Obviously not. So, the only logical explanation is that if they cooperated with Linux developers, they might have troubles with Microsoft. It would be very easy for Microsoft to no longer send the latest beta version of Windows or Windows NT to companies that release products compatible with Linux. None of this would be said explicitly, of course. But they would just answer: "Oh, you haven't received the latest Windows beta? The package must have gotten lost." After a few days, the company would understand, change two or three specifications of its product without telling Linux developers, and make sure that Microsoft is aware of it. And then, suddenly, as if by

miracle, they would receive the beta software they had been waiting for the next day. You can find lots of stories like this on the Internet. But, obviously, none of this can be proven.

We have seen that Microsoft's commercial practices are, to you, both like steamrollers and nuclear deterrents. What about offensives that it has made against its direct competitors?

Microsoft's corporate culture is based on eliminating competitors. The most insidious and efficient way to kill off competing products is to use the "network effect" (which deals with the interoperability between different applications), described earlier, to export its Windows monopoly to all the other sectors of the computer industry. When a software publisher owns both the operating system (Windows) and the applications (Word, Excel, Explorer), it is technically possible for it to modify the operating system to ensure that competing products are either unstable or unusable, at the same time as it improves the performance of its own programs.

How does this work? We have already seen that Microsoft's programs can modify components of the computer's operating system to adapt it to their needs. For example, let's say you wish to install a copy of Microsoft Word. Not only does the program get copied to your hard disk, but the installation procedure also modifies some components of the operating system, especially shared libraries (DLLs), whose program code is used by several programs. These modifications would be impossible if the vital components of the system were locked. And, in a reasonable world, it should only be possible to touch these components very rarely, during major updates, or if problems need to be corrected. But in the world of Microsoft, any program can modify a few of Windows' DLLs. This is supposed to be done just to adapt Windows to its needs; but there are also, undoubtedly, other dubious reasons for this (note 24).

It is easy, for example, for these applications to verify the type of operating system, and to slow down or stop working if they find a competitor's product. This is exactly the nature of the lawsuit filed by Caldera against Microsoft (note 25). Caldera is the company that purchased the rights for the DR-DOS operating system, a cousin of the original QDOS, from Novell. According to Caldera, when Microsoft released Windows 3.1 (and this problem continues under Windows 95), a software layer which runs on top of DOS-type systems to make them more user-friendly, the program runs a test to find which operating system the computer is using. If the computer responds DR-DOS, Windows 3.1 refuses to run. It requires that MS-DOS be present! I hope that these accusations can soon be verified, now that the courts have ordered Microsoft to provide Caldera's lawyers with the source code for Windows 95 (note 26).

It is easy to imagine a similar but opposite maneuver between the operating system and other applications. I have noticed that if I install the Internet Explorer browser on a PC which already has Netscape Navigator installed on it, Netscape's program starts running much more slowly. The only plausible hypothesis is that when Internet Explorer is installed, it modifies some components of Windows, which, because of this modification, prevent Netscape Navigator from running correctly. I must stress the use of the word possible, because it is very difficult to prove this sort of action: the source code of all these programs is protected by copyright. In any case, it

seems that this practice has been around for quite sometime: it was quite well known, in the 1980s, that the very popular spreadsheet program Lotus 1-2-3 ran very slowly under DOS. There was even a joke among computer specialists back then: "DOS is not done until Lotus 1-2-3 is undone".

So, it is technically possible for Microsoft to sabotage its competitors' products on the sly when they run on its platform. And since a PC program that is not perfectly compatible with Windows is a dead product, this technique can be incredibly efficient. These are practices that remind one of the insidious properties of ivy, that is said to poison the roots of nearby plants. Try and put a thyme plant next to some ivy, and it will die in a few weeks. This is practically always the fate that awaits software publishers who think they can release programs that are better than Microsoft's and have them run under Windows.

And once Microsoft has prevented its competitors' programs from working, all it has to do is take over the market with its own software?

Exactly. Microsoft is even so powerful that all it needs to do is to announce a new product that competes with an existing program, or a new version of one of its programs, without releasing it immediately. This practice of announcing new programs that do not exist is very common in the computer industry, and is called vaporware. Microsoft is the champion of vaporware. Often this is just a bluff, the high-tech equivalent of "pie in the sky". This is a way of promising a chicken tomorrow instead of an egg today. And all you end up with is an egg tomorrow instead of a chicken today. Consumers decide to not purchase inexpensive products which have been tested and proven, because Microsoft promises them that tomorrow they will release an extraordinary program that does much better. Unfortunately, when your name is Microsoft, you get so much free publicity, and you sell to uneducated consumers, vaporware can prevent competitors from getting market share they might be able to achieve, and also gives Microsoft the time it needs to prepare its attacks.

The first well-known example of vaporware was in 1988 when Microsoft launched Word 3.0. Bill Gates presented a demo of a prototype that was full of bugs, and even crashed his computer. But once this demo was made, people stopped buying its competitor WordPerfect. This practice is still continuing: in the spring of 1998, Microsoft explained that it would soon release a beta version of Windows NT 5.0 for workstations and servers, that would contain all the advanced functions of Novell's server software, together with many additional functions. But, as of December 1998, this "miracle" was nowhere to be seen. This strategy is very clear: Microsoft is inciting customers to purchase NT 4.0, and wait for the upcoming improvements that will be made for the version 5.0, instead of choosing products which are available immediately, such as Novell's NDS, or Hewlett Packard or Sun servers, for example.

Microsoft's other controversial practice consists in bundling new programs with products where they already have a quasi-monopoly…

Yes, Microsoft uses its coercive power to impose its new programs, that are often of a lower quality than others existing on the market, together with products where they have a monopoly. Example: Windows 98 contains the PIM program Outlook that has made publishers of similar products furious. How can you convince users to purchase a competitor's product, when they already own Outlook, that is bundled with Windows 98, and that they have therefore already paid for with the operating system?

The most flagrant example of this practice, which is at the heart of the Justice Department's antitrust suit, is Microsoft's practices involving Internet Explorer. Even Bill Gates admitted that Internet Explorer started out as a very poor program (note 27). Christian Wildfeuer, a Microsoft executive quoted by Time magazine, recognized this in an e-mail message of February 1997: "It seems clear that it will be very hard to increase market share on the merits of Internet Explorer 4 alone. It will be more important to leverage the Operating System asset to make people use IE instead of Navigator."

To impose Internet Explorer, exactly like it previously tried to impose its MSN online service, Microsoft asked computer manufacturers to pre-install this program on their computers, at the same time as they installed Windows 95. Then, as Microsoft slowly shifted its priorities toward conquering the Internet, the next step was to integrate Internet Explorer into Windows 98: to plant its roots into the code of the operating system, so it would be very difficult to eliminate. Microsoft's spin, to the medias and the general public, was that Internet Explorer was a "plus" given by Microsoft. This clever move allowed Microsoft to impose Internet Explorer and take away market share from Netscape Navigator. At the same time it tried to look good to its customers, since it was giving them this browser as a "gift".

But why, as a consumer, should I refuse a free program, that simplifies my life as well, since I do not have Netscape Navigator?

Because, by doing so, you are helping Microsoft build a monopoly over information transmission, and this is against your best interests. This is a sort of Trojan horse which, in the long term, may completely eliminate your possibility of making a choice. But is it really a gift? Consumers must pay $109 to upgrade from Windows 95 to Windows 98 (or $209 for those who do not yet have Windows 95). But, when you buy a new computer, you pay for Windows with the computer. Microsoft now pretends that Internet Explorer is an integral part of Windows 98. So, saying that Internet Explorer, that is bundled with (or, more correctly, included with) Windows, is free, while the rest is your real cost, is merely creative accounting.

Netscape Navigator, which was renamed Netscape Communicator, is not only free, but it is now an open source program. This means that its source code has been put into the public domain (see chapter 5).

Let me show you how the idea of price is artificial in the world of Microsoft. There is no better example than that of the Windows NT operating system. Microsoft sells two versions of Windows NT: one, NT Workstation, is used on the client computer, the one that receives

information from the server, and is sold for $319. The other, NT Server, is used by the machine that distributes data, the server, and is sold for $809. NT Server also contains additional programs used for servers such as Internet Information Server, that Microsoft claims are "free". But let us look more closely at what these CD-Roms actually contain. If you remove everything that is artificially "free", both programs have exactly the same code… except for a few bits. The only difference is an entry in the registry that contains the word "Workstation" or "Server", plus one other tiny bit, very well hidden, to make it difficult for people who wish to save $490 by changing the workstation program into the server program.

The conclusion is that if Microsoft is telling the truth, that is, if all the programs included in the NT Server package (IIS, etc.) are free, then these two tiny keys which take up a few bits cost $490. Once you realize this, it is hard to get rid of the terrible feeling of having been not only taken in but outright swindled (note 28).

But lets's go back to the browsers. It is important to understand that when you accept to use Internet Explorer (even if it's free), you are the one giving Microsoft an incredible gift. You will be statistically considered to be an additional user of Internet Explorer. And in the war for standards, market shares are worth their weight in gold, even if they do not bring immediate profits. In fact, once Internet Explorer has reached 80 or 90% of the Internet browser market, this will give Microsoft additional leverage so it can extend its control over the Internet. Microsoft can then first modify its programs slightly so that the server that works best with Internet Explorer just happens to be Microsoft Windows NT, using the Internet Information Server program. And according to some Net surfers, this may already be the case: IIS replies more quickly to a request from Internet Explorer than from other browsers.

Microsoft can then contact all the major content providers on the Internet — companies such as Time Warner and Disney — and tell them that they absolutely must use Windows NT servers. As of June 1998, Microsoft already had 22% of this market, versus 9% for Netscape, and 49% for the open source program Apache, according to a study by Netcraft. If Microsoft can control the browser, server and computer market, it will then be very easy for them to "Microsoften" the communication protocols used between these different elements of the chain. This, as we have seen, would lead to almost total control over information.

Can the effects of these practices, that you consider dangerous, be seen already?

People who find my argument excessive or caricatural need only look at what is happening on the Internet: some Web sites that belong to Microsoft are already off-limits to people using other browsers, such as Netscape Navigator, Lynx, OmniWeb or Opera. Example: Netscape Navigator users who tried to connect to the Internet Gaming Zone, one of the best online strategy game sites, shortly after Microsoft purchased it in 1996, could see a message stating that the site was unable to work with Netscape 3.0, and suggested that users download Internet Explorer instead. Things changed after users complained: now the page also has a link to download Netscape 4, but, alas, you still cannot play if you are not running Windows. Maybe this is why this site has been recently renamed the "MSN Gaming Zone"! (note 28a)

Technical reasons cannot justify this type of sectarianism practiced by Microsoft sites: the Internet Gaming Zone, for example, worked fine with Netscape before Microsoft purchased the site, and it obviously required that they invest time and money to change the site so it would no longer work with Netscape.

Let me give you another example that occurred in France: the French government uses a program called Nabucco for its financial management. The program was designed so any remote client can access it using the open Telnet protocol, one of those thousand-and-one free components that are the foundation of the Internet. This means that a Macintosh, a Sun workstation or a PC running Linux can all be used, with a bit of effort, as workstations with this program. Unfortunately, the new version of Nabucco is going to be "integrated" into Windows, in such a way that only people using PCs under Windows can connect to it. Nothing required the French government to make a choice that is definitely not in its best interest.

This voluntary incompatibility of Microsoft's sites with its competitors' browsers (which, it is important to point out, are used by at least 45 million netsurfers!) leads one to think that Microsoft's Web activity exists more to reinforce its domination in the software industry than to build a new business. In any case, with 55% of the browser market, Microsoft has convinced a growing number of independent content providers to optimize their sites for Internet Explorer, and in some cases to make it impossible for other browsers to use it.

This is the case with the British store Tesco's Internet Superstore (note 29), which, under the pretext that it only uses "the most modern Internet technologies", forbids access to its site to browsers which are not compatible with Microsoft ActiveX or BVScript. What a foolish policy! What it comes down to is that Tesco has invested money to cut itself off from half of its potential customers. It would be absurd to open a new supermarket that would only accept, for example, customers wearing brown shoes!

I would like to make a more general remark here about the "terrorism" of statistics and market shares. When a program is included with Windows, each Windows user is automatically considered as a user of that program. These statistics are somewhat misleading. Look at my situation: since I have already purchased four computers with Windows pre-installed, computer industry statistics count me as four Windows users. Whereas the first thing I did as soon as I got each of these computers was uninstall Windows and replace it with NextStep or Linux!

With a bank account of $14 billion in cash, it seems that Microsoft can just buy whatever it wants, or whatever bothers it?

Yes, as soon as Microsoft spots something interesting on its radar screen, the company does everything necessary to ensure that this product does not get in its way. Whatever its motivations may be, Microsoft acquires, or invests in, about thirty technological companies every year around the world. These investments are in fields as varied as operating systems, application software, servers, multimedia and Internet standards, Java technology, electronic

banking, new interactive electronic medias, video games, network access and cable. There is a Web site that has an impressive list of Microsoft's purchases (note 30), and you can also consult the "official" version, that is obviously less explicit, at Microsoft's site (note 31).

Microsoft has already eliminated small potential competitors by taking over their technology. There are cases where Microsoft has purely and simply stolen products from small competitors, by shamelessly copying their technology to integrate it into its solutions. This is what happened, for example, with Stac, the company that designed the hard disk compression software Stacker, who managed to prove this was the case and won its suit against Microsoft (note 32). Another example is TV Host, whose TV Guide was, according to its vice-president Mike Jeffress, simply copied and integrated into Windows 98 (note 33).

In other situations, Microsoft actually purchases licenses to use technologies where it has no expertise, or sometimes it purchases the companies that have invented these technologies. These operations are called buy-ins. In this manner, Microsoft purchased Web TV, and overnight became involved in set-top box Internet access. Usually, when Microsoft buys technology from a smaller company, this company is just pushed out of the market. Two of Microsoft's recent "partners" have filed suit against them for this type of practice. The first is Spyglass, whose Mosaic program was used as the foundation for Internet Explorer. In the license agreement they originally signed, Spyglass was to receive a small percentage of royalties for Internet Explorer. But when Microsoft decided to give the browser away for free, and stopped paying royalties to Spyglass, they filed suit (note 34).

The most significant case is probably that of RealNetworks, the company that introduced the popular RealAudio standard for streaming audio over the Web. Since Microsoft's goal is to control all the standards used on the Internet, it tried to purchase RealNetworks. But its CEO, Rob Glaser, only wanted to sell 10% of its capital, in exchange for a license on part of its technology. This was a very bad idea: Microsoft used this knowledge to develop NetShow, a competitive product, that it is now distributing "for free". Microsoft then refused to purchase licenses for the new versions of RealAudio and RealVideo. And, according to Rob Glaser, Microsoft also modified its software to prevent RealAudio from operating correctly (note 35). And now that NetShow is around, Microsoft sold its interest in RealNetworks.

A similar complaint, alleging that Microsoft "tweaked" the code of Windows and Internet Explorer, to hamper the functionality of a competing product, is the one voiced by Avadis Tevanian of Apple during the Microsoft trial: QuickTime, a well-known multimedia and streaming technology developed by Apple, would, in some cases, not be able to function properly due to new "features" added in recent releases of Internet Explorer.

There are other situations where Microsoft did not purchase a specific technology, but actually just purchased market share that it was not able to conquer on its own: the 9 million subscribers to the free e-mail service Hotmail discovered, one day, that they had become part of the MSN Internet Start site. Demographics are strategic in the Internet portal war.

There are other operations, called buy-outs, that are purely negative techniques whose goal is to kill the technology or the product that is purchased, so that a competitor's platform no longer has an edge. One key example is the war between Microsoft and Java. Java is an open language developed by Sun Microsystems, that resolves the problems of differences in platforms. Using Java, people will no longer need a Windows computer to run interesting programs over the Internet. But for Java to be an efficient competitor, this language needs to have a software offer, such as word processors and spreadsheets, so there is a good development environment for companies who wish to create Java products. An innovative small company, Cooper & Peters, had designed an office suite called EyeOpener, that could have become the equivalent of Microsoft Office for any computer running Java, including of course computers that do not run Windows (note 36). Well, Microsoft bought out EyeOpener, shortly after the program was presented, officially to "accelerate the penetration of Microsoft's Java libraries". But now, this product seems to have disappeared. It is hard to not think that the only reason to purchase this company was to eliminate a subversive program.

When Microsoft cannot buy out products or companies, they buy out grey matter. This is what happened with Borland's team of developers, who had designed an excellent compiler for the Delphi programming language. Was Delphi a thorn in Microsoft's side, since its products are of a lesser quality? Well, Microsoft made a golden bridge for these programers to get them to come work on its own products. This is not formally illegal, but it is against standard practices in the profession (note 37). Since then, Borland has given up the minefield where Microsoft declared war, changed its name to Inprise, and is looking for another market niche.

These practices are certainly brutal, but why are they reprehensible? Aren't they really just a standard application of the basic rules of business: kill your competition, as long as it is still weak?

Buy-in and buy-out maneuvers are probably not illegal, except when there is blatant copying of patented intellectual property. But when a key player, who is as rich as Microsoft, does this at such a level, this represents a risk for the creativity of the industry. The only guarantee for progress is that innovation may exist unfettered. Especially when the universal technological censor has Microsoft's appalling level of scientific knowledge. Take Windows CE developers' conferences: you see the sad spectacle of serfs who are looking for crumbs on the table of their lord. They all basically ask: "What can I do that will not interest Microsoft right away?" Microsoft only needs to say, for example: "it would be a good idea to include handwriting-recognition in our next operating system; no one else should touch this domain." When it functions like this, it doesn't even need vaporware anymore.

The only "good" innovations are those that serve Microsoft's interests. But are we sure, to paraphrase something that was often said in the recent past about General Motors, that what is good for Microsoft is good for the world? Larry Ellison, the CEO of Oracle and Bill Gates' sworn enemy, describes this phenomenon as "a fight between Microsoft and Humanity… and Humanity is being left at the gate!"

Doesn't the acceptance of these practices come from the fact that the standardization around the "Wintel" platform is a driving force for the computer industry? And that thousands of companies are living off the PC market that is held by Microsoft? And don't all users, whether professionals or general public, benefit more from this than they suffer?

This argument, which is often presented by Microsoft's defenders, is quite simply ridiculous. Each time you want to defend a monopoly, you say it is better to have a bad standard than no standard at all. This is a very superficial analysis of the situation: as the standard holder's hegemony becomes established, the disadvantages largely outweigh any advantages that may have existed at the beginning. Because the company with a monopoly can then just maintain its technology and kill off any innovation. The false Microsoft standard, which is only the omnipresence of a brand that sells a varied line of products, runs the risk of actually inducing a much slower evolution of the industry than what would occur if there was no standard at all.

What is important is that it would be better to have a real standard — which must, to be called a standard, be open, documented and capable of guaranteeing the interoperability of different components — than a false standard, that is closed and modified every few minutes according to the whims of its exclusive owner. One of the best jokes told in Silicon Valley is a good example of this: how many Microsoft engineers does it take to change a light bulb? Zero, Bill Gates just has to declare that darkness has become a standard!

In any case, I find it very difficult to accept the idea that it is the Wintel standard that has opened the doors to this spectacular explosion of innovation. Don't forget that in the middle of the 1980s companies such as Amiga and Atari made powerful multimedia computers that were very innovative, while MS-DOS users were still typing "dir/w" on alphanumeric screens. And, at this time, the only relationship between a mouse and a computer was the chance of seeing the former nibble on the latter's power cable. During this period, the computer press explained that multimedia was a useless gadget, and something that was definitely not needed on computers in companies. Thanks to Microsoft, multimedia took off ten years late. Not to mention the Intel chips, with their terrible segmentation mechanism that worked with a no better Microsoft Basic limited to 64 kilobytes, that made it such that millions of computer users only used one tenth of the memory they had spent large amounts of money for, and this for years. No, the real cause of the recent boom in this industry is quite obviously the huge success of the Internet and the World Wide Web that Microsoft ignored for a long time. Books such as *Barbarians Led by Bill Gates*, written by two former Microsoft programers, explain this very well (note 38). Microsoft had nothing to do with the implementation of the open standards used for the World Wide Web that allowed for its spectacular evolution. On the contrary, these same standards used for the Web, together with the user-friendly interface that Web browsers present, are the very things that could allow users to avoid paying the "Windows tax". This would be one of the benefits of a universal platform, such as Java, since this language is complete enough that a program written in Java can run on any type of computer, with any type of operating system that has a Java Virtual Machine.

This is why Microsoft is trying both to "Microsoften" Java, which, by the way, has led to a lawsuit by Sun, and trying to control Internet standards. (At the time of publication of this book, Sun had just won a preliminary injunction against Microsoft, see note 38a) Unfortunately, this company may succeed, because what gives the Internet its strength is also its weakness; this network, that operates using open standards, is not really controlled by anyone. This means that there is no one large player, no huge company that can effectively defend it from hegemonic appetites.

And what about governments?

Governments do not seem to have understood the real stakes of this fight. Even worse, they apparently do not realize that they have an important role to play in the future of a technology which is so promising for all of us, but could also bring many dangers if it is corrupted and used by special interests. I truly believe that the real reaction can only come from the general public.

4

Buying Brain Power

While Microsoft has such a good reputation among the general public, they have an nonexistent or even negative reputation in academia…

Microsoft makes huge profits. This money has to be spent someplace. The company has been criticized for not investing in research and not giving any money to education. So, with a dual objective of attacking new markets and restoring its technological reputation, Microsoft has started a major offensive all around the world to try to woo members of the scientific and academic communities. These operations are pure public relations: the gifts made to major universities are merely a way for the company to try to bask in some of the prestige and credibility that these institutions have. This was the reason behind the "large" donation of $20 million that was made to Stanford University, a few years ago, to pay for a building that would be named after William Gates. The building ended up costing much more, but Gates would not give any more money, and inside this building, some of the rooms bear the names of Japanese philanthropists! Many people in Stanford regret that, by accepting this money, the university helped give a reputation to someone who had never had one in the field of science.

But isn't Microsoft now seeking recognition from the scientific establishment?

Microsoft has started investing in research, and this investment now exceeds $3 billion per year. The company claims to have created the Microsoft Research Laboratory in Redmond in 1991, but this laboratory only became visible and significant in 1995. It employs two hundred researchers, who are split into twelve groups working on subjects ranging from voice recognition and decision theory to 3-D graphics. After this American investment, Europe was the next theater of operations: in 1997, Microsoft invested $100 million to open a research laboratory in Cambridge, England, which is very close to Cambridge University's Computer Lab. The company is also investing in start-ups in the area together with local venture capitalists. Microsoft Research at Cambridge is planning to hire forty researchers who will work mainly on computer networks, cryptography and programming languages. There is also a similar project in India.

I must point out that until recently Microsoft employees had no credibility among the scientific community. Up until 1995, I had never seen anyone from Microsoft make any significant contributions to high level conferences in the fields I work in, unlike researchers from companies such as IBM or DEC. The company's current goal is to change this image. Microsoft is trying to attract well-known mathematicians and computer scientists to its

laboratories. Academia does not like this company, and it is trying to lure these researchers by offering them extraordinary working conditions. Not only are these scientists extremely well paid, but they are also truly free: they have no specific research agenda, and they can actually do whatever they want. It is also important to point out that companies that have traditionally had large research laboratories, such as Hewlett Packard or Digital (recently purchased by Compaq), are starting to run into difficulties financing them. People who want to do fundamental research with a huge budget and large salaries no longer have many choices. Microsoft uses these laboratories as a showcase for the press, its guests, and key customers; it shows them off in the same way as others would show their exotic curios or their collection of contemporary art to guests they want to impress.

But if Microsoft hires all these distinguished scientists, won't this have a positive influence on the long term quality and innovative character of its products?

It is difficult to say whether Microsoft will use what comes out of these labs to innovate. But the company's history tends to prove the opposite: a few years ago, Microsoft developed Xenix, a Unix system that could run on PCs. It owns the code and the rights that would have enabled its technicians to improve its file management system. But it has never used this technology. If we examine the motors behind Microsoft's progress, its success has never had anything to do with quality or innovation. There would have to be a cultural revolution within the company to change that. In any case, its current investments do not change my point of view of this company. Microsoft is simply shopping in the brainpower market, the same way as it goes shopping in the market for technology and innovative small businesses.

What will all this bring to the company? It will probably help improve its credibility, giving it a scientific alibi. Microsoft needs this now more than ever. It is at a strategic turning point. It has been easy for the company to sell its software to the general public using advertising and the computer press. But now that it is trying to enter professional markets with products that are more technical, such as servers, database management, satellite control and banking software, it will have to prove that it has a solid technological background to come up with reliable products.

You seem to be very skeptical about these initiatives…

I suspect that there is a motive hidden behind these investments: if Microsoft's leaders really want to conquer 100% of the target markets that were mentioned earlier, as they lead people to believe, the company will need to overcome the last stronghold of resistance - academia. Because academia cannot be subjugated by just a few good articles in computer magazines. Here, where I teach, at the École normale supérieure, as in other universities, there are students and professors whose goal is to study the fundamental problems of computers, without being concerned with any one company's brand image. Here we study "how" problems can be resolved, and not "how much" money can be earned by breaking these solutions down to maximize profit.

This leads us to compare hardware and software based on many different standards, to look under all the hoods, and to examine thousands of lines of code to understand how these programs operate, what their faults are and what is hidden behind these faults. In the end, this allows us to develop a free and independent opinion as to the quality of different companies' products.

Do you mean that the ultimate goal of this offensive on academia is to eliminate our free will?

Let's take an overall look at this strategy. Microsoft sells mediocre products that we don't want at high prices, and this monopolistic company is forcing us to pay a tax on information whenever it changes its standards. We have no legal redress if the products do not work as we expect them to. But we do have one remaining freedom: that of thinking, evaluating and creating our own opinion independently by comparing different solutions. And we also have the freedom to want to choose something else. It is very important to be able to compare things to then make a choice among them. And this comparison is made in places where the stakes are not financial, but based on knowledge. These places are called schools and universities.

Microsoft considers this attitude extremely subversive, because most of the company's commercial efforts are geared toward insidiously eliminating consumers' freedom of choice, by making them accept this totally unjustified hodgepodge between open infrastructures, such as the Internet, and extraordinary tools like computers on the one hand, and Microsoft products on the other hand. Unfortunately, this hodgepodge seems to be winning. If you ask a novice computer user in Argentina what the Internet is, you have a good chance of hearing them answer: "A Microsoft product".

The ability to test programs, and to compare them with others which run better, is, in some way, the last bastion against a total "Microsoftening" of the computer business. But if we start as early as kindergarten by preventing people from seeing other products, this choice will no longer exist. A simple example of this: if you eat nothing but fast food, your taste is corrupted for life. You find it hard to imagine that you can eat better food.

Should we then systematically avoid any relationships between universities and companies? This seems artificial in a field where research is geared toward applications.

Not at all. But this does not mean that the universities must sell out! Balanced cooperation must not be confused with control. We need to understand our goals. Schools and universities have a mission, which is to provide our youth with a lasting long-term education that must therefore be a quality education. To allow students to do what is impossible to do in companies: experiment with many different tools, without clinging to any specific one. The goal of this is to help them develop the skills of critical analysis that will make them competent in their fields (whether this is the computer field or not). It would be wonderful, when teaching a course about databases, text editors, Web browsers, or network transmission protocols, to not only deal with the theoretical aspects. To be able to try out a large variety of commercial products, and not only open source software, that is largely used in universities because it is free.

Unfortunately, almost all companies want to "sell" their products to schools, in one way or another, either by actually selling them for money, or ensuring that they will be the only ones used in these courses. It is impossible for universities to pay the hundreds or thousands of dollars for each person who is briefly testing Windows NT or any other proprietary system. And professors have no desire to be a party to this type of free advertising by only teaching their students how to use Word, Excel, Windows NT, Sybase or Oracle.

What these companies could do — which is in their own interest actually — would be to help universities seriously evaluate their products, and to compare them with others in a reasonable scientific manner. But giving universities unfettered access to their products would have to be done for free. As far as software is concerned, where it costs absolutely nothing to make an additional copy of a program, publishers could very well just give these programs to universities.

The problem is, as we have seen, that this type of policy ends up being counter-productive for companies like Microsoft: it would break down the myth surrounding its name. This would also result in the training of generations of educated consumers. Educated enough, in any case, to see through the lies in its advertising propaganda, and denounce them as I am doing here.

Let us look at Microsoft's actions toward schools in France. The Gr@ine de Multimedia program, organized with Hewlett-Packard, gave twelve French elementary schools personal computers. The education part of the Compétence 2000 program is about teaching computer skills to university level students and to teachers in training. What do you think about those initiatives?

These are certainly nothing like the gifts that would be given by a benevolent philanthropist: it is important to point out that Microsoft is in a win-win situation with these operations. What they are actually doing is killing four birds with one stone.

First, the company improves its public image. Second, it makes our children prescribers of Microsoft products today, and future purchasers tomorrow. Third, it gets a foot in the door of key markets, such as the education market, which is becoming extremely large. And fourth, it eliminates free will at the very time when this is beginning to take root.

It has already reached its first objective: thanks to the docility of reporters, Microsoft received a free public relations campaign about this operation, where the company was generally shown as a philanthropist giving schools the tools to help them adapt to the information society. Microsoft gave away 2.5 million francs (almost $450,000) of software during the Gr@ine de Multimedia program. And in the newspapers, we read that Microsoft is giving away 30 million francs (more than $5 million) of software with the Compétence 2000 program. In reality, unlike what the company shrewdly leads people to believe, these are not gifts, or if they are, they are really cheap!

When Hewlett Packard gave away computers for the Gr@ine de Multimedia program, this cost them real money. Not the 15,000 Francs (more than $2500) retail price that a French family would pay for a Pavilion PC, but perhaps half that amount. However, when Microsoft gives software away (and with the Compétence 2000 operation, this is not even the case, because you need to purchase one copy of a program!), this really only costs the company about a dollar for each CD-Rom. So, the only gift is the money saved by the school (a few hundred or a few thousand dollars saved on purchasing licenses for each computer where the program is installed). What this comes down to is that the company is not making what it would have made if it had sold the programs at their normal price. So why is this philanthropy? The value of a gift is what it costs to the giver, not the theoretical market value. But this is exactly how Microsoft calculates its gifts in all the operations that it carries out, whether in the United States, France, Switzerland, or South Africa.

If it were a real gift, with no strings attached, the beneficiary would have a choice. Andrew Carnegie, the great American philanthropist of the beginning of the century, did not found Carnegie Mellon University by giving tons of steel from the Carnegie Steel Company factories. No, he gave money that the university was free to use to build buildings using the materials that they desired, whether it be bricks, wood or concrete. And he acted the same way with his public library project. Microsoft's "gifts", on the other hand, are just another way for them to catch their beneficiaries in the snare of their proprietary standards. If the company really wanted to be generous, it could just give away money that each school would use to buy whatever they want, even if they were to buy Macintosh computers or Netscape software.

But it is very difficult for these institutions with tight budgets to refuse hardware and software donations.

No, this is not really a problem. Because other solutions, which cost less than these so-called gifts, exist, especially for educational institutions: those based on open source software (see chapter 5). In addition, even if, at the beginning, these companies make enticing proposals to get into the market, nothing proves that they will not increase their prices afterward. This is the classic method used by drug dealers who give away the first dose for free. There are already some examples of this: in December 1997, Microsoft announced that they were eliminating "site licenses" in Japan, and began similar actions all around the world (note 39). This type of license authorized universities to pay for their software according to its actual use, rather than according to the number of computers where it was installed. These changes will bring about huge cost increases, that the Japanese will have to pay, because there are no competing companies that they can turn to.

Another reason to look for solutions based on open source software is that you can use computers that are supposedly out-of-date instead of the expensive computers that are needed to run Windows! There is an interesting example of this in Switzerland. In October 1997, the Swiss Ministry of Finance announced a deal with Microsoft, which was as follows: the Swiss government gave middle-schools 2,500 computers that they no longer used; and Microsoft gave the same number of licenses for Windows 95 and Internet Explorer, and also trained 600

teachers to use the computers. This cost much less than an advertising campaign, and in this way Microsoft was able to establish its hegemony on computers in middle-schools (and therefore, in Swiss companies when these students, who have never used any software other than Microsoft Office, reach the job market).

This initiative eventually collapsed. Why? Because most of the old PCs that the Swiss government gave to the schools had old chips — 486s — that were totally unable to run Windows 95, which, as we have seen, requires powerful computers. So, if they want to accept "gifts" from the software monopolist, they would have to spend a fortune buying hardware. I hope the Swiss take advantage of this occasion to use open source software, such as Linux or FreeBSD, on all the computers that couldn't be used for anything else.

Is Microsoft carrying out similar offensives on schools in other countries?

We have already seen what has taken place in Switzerland. A program was offered to the University of Buenos Aires, in Argentina (and fortunately, refused). Some of my colleagues have mentioned that they were under pressure to accept the program, similar to the pressure used by the BSA against Antel in Uruguay. In the United States, where this situation has been around for longer, its conquest has gotten further. Here is an example: in 1997, California State University (CSU) gave their support for the creation of a corporation called CETI, which was set up by Microsoft, GTE Fujitsu and Hughes Electronics. In exchange for an investment of several hundred million dollars over ten years for developing network infrastructure, CETI would have the right to select the computers and software that would be recommended by the twenty-three universities of the CSU system, that counts 350,000 students and teachers. Is this surprising? CETI's proposal only mentions Windows 95, Windows NT and Microsoft Office. Not only would CETI have had a decisive influence on the training of tomorrow's deciders, through the creation of specialized "proprietary" computer courses, but it also would have made several billions of dollars in profits over ten years. This commercial masterstroke, all of whose decisions were made behind closed doors by its managers, was just barely avoided thanks to the exceptional mobilization of CSU's students and teachers, relayed by organizations such as NetAction (note 42).

However, there are other lesser known — and poorer — universities that have already been "Microsoftened". Idaho State University Business School (note 43) offers courses in Web design, which is a good initiative. The problem is that when you visit their site, you discover that these courses are "based on Microsoft technology", and, what is more, are "sponsored" by Microsoft. The site's main page contains several advertising icons for Internet Explorer and BackOffice. The list of programs recommended for these courses only contains Microsoft software, and each one is the subject of a specific course module. Finally, there are two books recommended: one is a general book, and the other is published by Microsoft Press on OLE and ActiveX technologies (we have already seen the incredible security loopholes in these technologies). There are no traces, however, of books on the standard Web protocols such as HTML or TCP/IP, or on the most commonly used languages such as Perl and Java. These are

certainly courses that will train managers who will be convinced that the Internet is a Microsoft innovation!

To better penetrate university campuses, Microsoft has also developed a small network of correspondents: a Brain Trust of a dozen leading personalities, called Microsoft Scholars. Microsoft, who pays these advisers $10,000 per year, is hoping that in return for this salary they will learn more about the best way to work with academia. These Scholars are obviously people who spend most of their time thinking about or giving lectures on how information technology is used in higher education. Many of these scholars — such as Steve Gilbert, a technology consultant affiliated with the Association For Higher Education, or Kenneth Green, who publishes an annual report on computers in universities — have direct influence on purchases of computer equipment by universities. Some people in the United States see this as a major conflict of interest: how can you remain impartial to a company that pays you? (note 44)

In addition to Microsoft's economic and financial power, one way it flexes its muscles is by maintaining a very positive brand image. This is done in such a way that most people see Microsoft as a synonym of cutting-edge software, and modernism. Why is the computer press, as well as the general press, so willing to present what you say is just a myth?

I think the reason for this is very simple: we are just human beings. And no one has really gotten used to the incredible speed at which changes occur in the computer industry. Journalists do not have enough time to analyze products in depth. And when they do it in a laboratory, they are usually limited to comparing commercial products that are relatively similar, sent to them by the vendors. They do not make sufficient analyses to point out that there really are alternative solutions. Is it because of ignorance or a lack of advertisers that the computer press has spent years basically ignoring the phenomenon of open source software, which is at the very heart of the Internet?

The other reason — and I have discovered this myself — is that writing articles understandable to the general public requires a huge amount of time and energy. It is very tempting to just copy information from a well-written press release, supplied by some software publisher. This is why it would be interesting to establish cooperation between universities and computer magazines: it is about time that computer journalists try to get quality information from universities and researchers, and that these people take the time to supply it.

The general press makes the same mistakes. When Microsoft announced that they would be investing 30 million francs in computer training in France, it took a fair amount of time, thinking, and knowledge, to imagine that these figures were merely hiding virtual money. It was then necessary to carry out an investigation to get a copy of the consensus statement that was sent to the universities, and that Microsoft, of course, did not include in its press kit. Finally, it took time to carefully read this very thick document. And if, in spite of all this, a reporter writes articles that cause problems for Microsoft, the impenitent writer is likely to be assigned a "tutor" from the Waggener-Edstrom agency, who handles Microsoft's public relations. Or, in

most serious cases, from Microsoft itself, as a recent article from the San Jose Mercury News shows (note 45).

It must also be emphasized that Microsoft has become a virtuoso at lobbying and public relations. They never used to need this before, but now that they are being investigated for antitrust violations, this is very useful. What does the leading software publisher do when controversy is stirred up about its hegemony? It acts as a defender of the arts, culture and education. The build-up of its image has become a strategic weapon for Microsoft, in recent years, and is the focus of huge investments.

But, when the Internet is full of newsgroups such as alt.destroy.microsoft or Web sites such as stopgates.com or enemy.org (note 46), it is also important to touch up its image with the general public! Bill Gates, who was never before interested in charity, recently went on a tour of the United States announcing the creation of the Gates Library Foundation, which will finance computer equipment for sixteen thousand libraries in inner city neighborhoods (note 47). Microsoft also organizes trips to Redmond for journalists, politicians and VIPs from all around the world. All of its international subsidiaries also organize luxurious press junkets, where Microsoft explains its vision of the industry, and gives out information on its latest products. Because of all of these events, there is a certain collusion between media editors and Microsoft managers. How could these publications make serious criticism of the generous advertisers that keep them alive?

5

The Serfs' Revolt

If we follow your entire argument, it seems as though there is no way out, Do consumers still have any choice? Are there any alternative solutions, especially in Europe where people feel guilty about being technologically "behind"?

Solutions do exist, and they are very interesting, economically, technologically and socially, but they are not very well known. Before presenting some of these solutions, let me just point out that this being "behind" may actually turn out to be an advantage for Europe. Are we under-equipped? This is actually good: it means that we have the possibility to make important choices, and we still have time to avoid some of the traps that certain companies have set for us. "Missing a train" is actually quite fortunate, if that train derails! We can still choose to give our children access to efficient open source computer systems. In addition, this choice can help create jobs. Such a choice was recently made in Mexico, where 140,000 schools in the country will be equipped with computers running Linux. (note 47a)

To understand exactly what these alternatives are, you need to have a precise idea of the different possibilities available when you purchase a computer. There are four major elements in a computer system: hardware, the operating system, applications, and standards used for file formats and communication protocols. Unlike what many people believe, these four elements are actually quite independent. This means that the choice of one component does not necessarily determine your choices for all the others. Let us look more closely at this.

— Hardware: this is the type of computer you purchase. There are a thousand and one PC models with Intel or other chips (with all their wonderful configuration problems), Macintoshes (with G3 chips), Sun workstations (with Sparc chips), Hewlett Packard workstations (with HPPA chips) or Digital workstations (with Alpha chips); there are also other computers made by Silicon Graphics, IBM, etc.

— Operating systems: once you have purchased your hardware, you are still free to choose which operating system you will use on the computer. Microsoft is obviously not the only company in the world that sells one. Even if there is a high probability that you have already paid for Windows 98 or Windows NT, that was pre-installed on your PC, this does not mean that you cannot install a product that might fit your needs better. There are other operating systems with proven qualities. On a PC, for example, you can choose one of the many open source operating systems, such as Linux or FreeBSD, or other proprietary systems, such as OpenStep or NewDeal (that can be used on old 286s with students (note 48)), SCO Unix, or

Solaris. On a Macintosh, you can use Mac OS, which is superior to Windows in its ease of use, and is technically better for graphical applications. The general public probably does not realize that most computer magazines (even those that only write about PCs) work on Macintoshes. Most newspapers also use Macintoshes and programs such as Quark Xpress. There is also a version of Linux that runs very well on the Macintosh, thanks to the support given to Linux developers by Apple.

— Applications. Now you have a computer and an operating system. But, unless you have chosen an operating system such as Linux or FreeBSD, you don't have very much to work with. There are no C or Pascal compilers, no text editors, no Web servers, no News server, and no e-mail servers. In the best of cases, you may have a Web browser and a simple program to read your e-mail. You will need to purchase applications, such Word or WordPerfect or ApplixWords or StarWriter, etc. to edit text; Apache, Netscape Commerce Server, IIS as your Web server, and Sendmail or Lotus Domino or Microsoft Exchange for e-mail. Here, too, the best products are not always those that we hear the most about. And sometimes the best programs are actually free.

— Finally, as far as file formats and communication protocols are concerned, there are two types of protocols and formats: the closed, proprietary formats (Microsoft's "Klingon"), and free, open, documented protocols and formats. This choice may be both the most important, and the easiest to make. Even if you are a faithful Microsoft customer, and are proud of having spent a fortune purchasing successive versions of Windows, Office, Exchange, etc., to be up-to-date with what I find it difficult to call technology, you are still free to choose which format you will use to save your files and which communication protocols you will use to connect your computer to the rest of the world.

Even Microsoft Word now allows you to save files in HTML, the language used on the World Wide Web. With a few mouse clicks, you can send your colleagues files in HTML that anyone can read, and not in Klingon version x.y, which requires that this person has also decided to pay the Microsoft tax.

Public institutions are required to supply public information in a format that is accessible to all. Why should one have to buy a given proprietary program to read a legal text or a tender offer? Let me repeat, these formats do exist, and can present information correctly, and are even accessible to people who do use Word. In spite of letters of complaint from many scientists (including myself) one frequently finds on official European Union sites — such as http://www.cordis.lu — documents that can only be read by the most recent version of Microsoft Word. This is totally illogical, and not in anyone's best interest.

This point is probably the most unknown and yet the most important aspect of this issue, because it is precisely through the elimination of open standards and the introduction of proprietary standards that Microsoft is trying to replace the many open source and often free applications used at the heart of the Internet by its own products.

You, like many scholars, believe in open source software. What exactly is open source software?

Open source software is software supplied with its source code, which is the computer code used to create it, as well as all information needed to maintain it. You need to know that software programs, just like symphonies, are written in a sort of computer score, called source code. These programs are then, as for compact disks, distributed in the form of an "executable" version — a recording — of this score. Commercial publishers such as Microsoft sell executable versions of Windows, but are very careful to not reveal their source code. This comparison is not really perfect, however: if you buy a CD containing a recording of some music by Bach, it is possible to recreate the score after listening to the music, whereas with the complex software used today, this is almost impossible.

Computer programmers all around the world have designed open source software with an idea of sharing, and these programs are considered part of the world's collective property. This means they can be freely modified and redistributed, as long as they remain collective property. Anyone can make improvements to an open source program, as long as their changes are added to the package. But this does not mean that these programs are "in the public domain": to prevent that open source programs be taken over by unscrupulous companies, who would then sell them without their source code, specific licenses such as the GNU Public License (GPL), or the Berkeley Public License were created. These licenses establish the intellectual property of the program, along with the conditions for their distribution: these rules are the exact opposite of those existing for Windows. Everyone has the right to modify the program and distribute it in any way they wish, as long as they too include the source code, and distribute it under the same conditions.

There is a certain confusion sometimes around this type of software. Two terms are used to describe it: open source software and free software. Both are the same, but open source stresses the fact that the source code is available, and free that the software is freely available. In this case, don't think free as in free beer, but rather free speech. On top of that, open source software is not necessarily free. And free software is not necessarily open sourced.

Let me give you some examples to clear this up: most programs called freeware (and not free software) that are found on many Web sites are free, but they are certainly not open source software, because the source code necessary to look under the hood and take the engine apart is not provided. In this category of freeware you will find such examples as Adobe's Acrobat Reader, and Internet Explorer (that is, if we pretend the creative accounting that we previously presented does not exist).

Linux, however, is free, open source software, because its source code is given to you freely, and if you download it from the Web it does not cost anything. But you can also buy commercial "distributions" of Linux (such as SlackWare, RedHat, SuSE, OpenLinux etc.). In this case you pay the added value that corresponds to its commercialization — pressing CD-Roms, distribution to stores — and most often additional services: installation, technical support or development of specific solutions. Once you have purchased a copy, however, there is no

BSA to check on you to make sure that you have paid for as many licenses as the number of copies you have installed. My Linux CD, that cost a few dollars, has already been used legally to install the software on more than twenty computers.

What is the advantage of this open source software?

Open source software has many advantages for users. It generally runs better and is more stable than its commercial equivalents, because the possibility of having access to the source code makes it much easier to correct errors and to develop specific solutions. It is available for limited cost or nothing at all, and can be freely and legally copied on an unlimited number of computers. Open source software is generally designed more economically, and can run on older machines such as 486 PCs, and sometimes even on 386s, that the Windows-Intel cartel claims are obsolete. Unlike Windows or Mac OS, operating systems like Linux are generally resistant to the type of errors that beginners may make, because only authorized users can access the system's vital components. Even better: several users can share one computer, and each one has their own work space on the computer's hard disk and their own specific permissions.

Finally, and above all, access to the source code of these programs is the only true guarantee of permanence and independence of users from software publishers. Open source software is part of a larger idea of open source computing that ensures the interoperability of products among each other by the publication of the technical interfaces for each program. An open source program is a bit like a good car engine that is easy to work on, that you can repair or soup up if you need to. On the contrary, Microsoft's engine is double-locked, and only Microsoft "mechanics" can get under the hood. What is more, even if this engine does run correctly, you will have to replace it entirely at a high cost each time the Microsoft "gas station" changes the formula of its gas!

Don't forget that reconstructing the score from the music is almost impossible with software, which means that if a commercial company loses its accidentally score, that was jealously kept in a safe, during a natural catastrophe (an earthquake, an explosion) or a "virtual" catastrophe (a "blue screen of death" a bit more serious than usual), no new music will come out of this company! However, open source software is copied millions of times around the world, and each time with its score: there is nothing more resistant to catastrophes, be they natural, virtual or commercial ones such as buy outs.

But how did this community of volunteer developers get together? And what are the main programs that they have created?

The idea of open source software is very old. But if I had to choose a specific event that marked a turning point in its history, it would, without doubt, be Richard Stallman's initiative in the 1980s. Stallman was a researcher at the Massachusetts Institute of Technology (MIT) in Boston, and he had written Emacs, one of the most sophisticated text editors available, that is very popular in academia. Stallman is one of the founders of the Free Software Foundation, whose purpose was to produce an entirely free operating system called GNU, which is a recursive

acronym for GNU is Not Unix (note 49). This foundation also created the GNU Public License, giving legal protection to this model of software distribution. GNU — whose logo is a gnu — set up the foundations that made it possible for a young Finn to create the Linux operating system, which is currently the most well known open source program.

The story of the birth of Linux is a good example of the spectacular role the Internet has played since the beginning of the decade. It has been used as a space for collective design, as a conduit for transmitting software, and as a tool for providing technical support. Let's go back to 1991: Linus Torvalds, a student at the University of Helsinki, had just received what was then the cutting edge of personal computers from his parents — a 386. But the two operating systems he could run on this computer, DOS and Windows 3, had neither the level of performance nor the level of security of the more expensive Unix that he used on the powerful computers at his university. So, this brilliant and enthusiastic twenty-one year old computer programmer used the GNU tools to write Linux, a compound made up of the words Linus and Unix (note 50).

As his project progressed, Linus Torvalds made his source code available online, so it could be finished and touched up by the best programmers in the world. This free program, which is available today for PCs, Macintoshes and other types of computers, quickly earned a strong reputation: Linux has flown on the American space shuttle, was used to create the special effects for the movie Titanic, and handles mail distribution for the US Post Office. It is also used for a great deal of industrial projects (note 51), and it is even used by the US Navy in San Diego, where it seems to work much better than Windows NT, that, as we have seen, crashed on boats that were at sea. Linux already counts 8 million users, and this figure doubles every year.

Before Linux, most computer scientists were convinced that writing a quality program required a private centralized approach. They thought, to use Eric Raymond's expression (note 52), that to design a program as complex as an operating system the only model that worked was the "cathedral", with an authoritarian architecture and a small group of docile programmers. But along came a Finnish kid who organized a bunch of computer hippies over the Internet, and proved that the wild confused "bazaar" model was superior.

The exemplary story of Linux should not, however, hide the vast amount of open source software available. The Apache Web server (50% of the world market), Netscape Navigator, the Sendmail e-mail management program, and the Internet Bind name server, to name just the best known such programs, are all leaders in their respective niches. More generally, open source software is used for the very foundation of the Internet. Without these programs, the network would not have seen the growth that it has experienced in recent years. And if these programs were eliminated, it would simply stop working.

Open source software seems to have staked out its place in the United States and in the north of Europe. What about elsewhere?

All of Europe, and France especially, have made important contributions to the development of open source software, even though the people active in these movements are not very present in

the media. A few examples will show that France has played a key role in open source software: the National Research Institute for Computers and Automation (INRIA) has developed more than 20 open source programs; the ext2 file system now used in all versions of Linux was developed by a professor at the Paris VI Univiersity; the Linux "Posix thread" library was written by a brilliant researcher from the INRIA in his free time; the multilingual extensions for the Apache Web server were written by a student at the Ecole normale supérieure; and some video card drivers were written by other French university professors.

If there is one place that France and the other European Union countries are really behind, it is in officially recognizing the magnitude of this phenomenon. France is only now beginning to open to these alternative ideas. A small group of French and French Canadian researchers and professors have created the French Language Linux Users' Association, the AFUL, that I am a member of (note 53).

The low cost and total control over open source software seem to make it an ideal solution for schools. But many people seem to be proposing that Windows NT be used as the network infrastructure for schools and universities…

We have already seen that solutions based on the Windows-Intel platform, expensive both for software and hardware, do not really offer sufficient levels of security or performance, and I am not only talking about Windows 95 and 98, but especially Windows NT. Unfortunately, Microsoft's powerful marketing force has managed to convince many decision-makers to ignore these negative aspects of its programs. But many international analysts, such as the Gartner Group, the Standish Group or the Aberdeen Group (note 54) are starting to publish studies which openly contradict Microsoft's arguments, and present the tremendous latent risks and costs which could result from replacing Unix servers by Windows NT servers (note 55).

Let us look at the example of an e-mail server: the Sendmail program, a free, open source program, has been used on the Internet for decades, but Microsoft's solution, Exchange Server to manage e-mail, costs $5,000 (for fifty clients), and is not efficient with large numbers of clients. This means that if you have five million users and not fifty, server performance plunges, which can be seen, paradoxically, with Hotmail. This Web-based service offers free e-mail addresses to more than 30 million users was purchased by Microsoft in December 1997. Well, Microsoft wanted to require that Hotmail use Windows NT to run their servers. Up until then, they were using a mixture of Sun Solaris and FreeBSD as their operating system, and Apache 1.2.1 as the server software. But it turned out that managing the then 9 million users was much too difficult for Windows NT and Hotmail had to reinstall Solaris (note 56)!

Another small example: Windows NT is not entirely compatible with Internet standards used for remote maintenance. Let me emphasize that Unix workstations (whether they are using Linux, SCO, Solaris, IRIX, AIX, HPUX or any other flavor of Unix), include the necessary tools to manage a server without being physically in front of its screen, using protocols such as telnet and rsh, and extremely flexible command languages. The server can even be used, if it is powerful enough, and does not have a high workload at a given time, for remote execution of

graphical applications, using a mouse, as if you were sitting in front of that same computer screen. Nothing like this can be done with NT: the only tools provided with the server are the program that allows it to be used a Web server, and the tools required to share files and printers. This is why it is so easy to replace a Windows NT server by a Linux server using the open source program Samba.

At the École normale supérieure, where I teach, we keep records of our computers' "uptime", which is the time between two successive restarts of the computer. We have three or four workstations that have been running continuously for more than one year, which is perfectly normal under Unix. However, under Windows NT, any time you make even the simplest change in network configuration you need to restart the program, and crashes are relatively common.

Up until now, you have been talking about Unix in general, which is traditionally considered to be a high level system, and therefore expensive… which means it is not accessible to public administrations.

Correction: a long time ago, Unix was in fact reserved only for those who could afford its high costs, and, unfortunately, certain ridiculous pricing policies, such as one database company that sold the Unix version of its program at five times the price of the Windows NT version, contributed to maintaining this situation. But the recent explosion of open source software has radically changed this: Linux, FreeBSD, and all the other free versions of Unix do not cost one cent, or more correctly they cost the price of a CD. The advantages of a Unix system are now accessible to users with any budget.

Let us examine some of the criticism that teachers have made about Windows-Intel solutions: hardware that is more than two years old cannot be used with recent operating systems; two successive versions of the same program are not always interoperable; and systems regularly suffer virus attacks and system performance decreases, because anyone can "mess with" the hard disk.

Well, using solutions based on open source software can eliminate most of these disadvantages. Costs are minimal since the programs are almost free, no matter how many copies are used, and the hardware used can be much older. These solutions are reliable, stable, and are very resistant to intentional or accidental attacks, be they by human beings or viruses.

Using and maintaining these operating systems is also easier. And their applications can be easily adapted to correspond more specifically to pedagogical needs.

Even better: access to the source code of these programs and the knowledge of their interfaces represents an extraordinary educational resource. This is what has been discovered in the many schools and universities that use this type of software.

While Linux may have developed a reputation because of its performance, it seems that it is still complicated to install, and even to use. Is it, therefore, not really accessible to the general public yet?

Linux is probably not yet ready to be used by the general public, and if I went around saying "Linux will solve all your problems", I would be probably be just as dishonest as the salespeople who tell you "Windows is the only real solution". Right now, the Linux operating system looks a bit like a Ferrari engine in an old unattractive car, like an old VW bus; whereas Windows looks like a shiny streamlined car with a motor that explodes every one hundred miles hidden inside.

So, the choice really depends on the type of person using the computer. What do you recommend?

Personally, I like to break computer users down into three different groups: experts, organized individuals and individuals. Let me give you my recommendations according to each group.

— Experts: these are computer users who have a high level of computer skills, such as people in large companies, research centers or universities. These people care little about the body of their car: they want a good engine, and they want to be able to soup up the body on their own, taking advantage of the availability of the source code. For this category, the choice is clear: Linux or FreeBSD (or any other free version of Unix, or even a commercial version of Unix).

— At the opposite end of the spectrum are individuals. These are users who are on their own. These are your basic computer users, who don't know much about computers, who are sometimes not even sure that they need a computer, but are interested in trying one out anyway. They'll use their computer to write letters, write resumes, or play "Doom" or "Quake". For these people, who usually purchase their computers in chain stores, Linux, in its current state, is not really an ideal solution, no more than WinTel computers, as they will discover the first time their computer crashes, or the first time they want to uninstall a baseball program. People who really want a computer just to play games should seriously consider buying a video game console (PlayStation, Nintendo or Sega), which, for a fraction of the cost of a PC, guarantees that they will have no problems.

But for those who really want a computer, I think that, until Linux's "body" is finalized, the best solution would be to buy an Apple computer: even if the engine is not the same as Unix, it is much more polished than what is found under the hood in WinTel PCs, and the interface is very user-friendly. The only problem, which used to be the higher cost of Macintoshes (note 57), now seems to be overcome with Apple's more economic recent models such as the iMac.

— In between these two categories, you find what I call organized individuals. These are people who have the same lack of computer skills as the general public, but can get help from the institutions that they depend on. This is the case for people such as doctors, lawyers, graphic artists, etc. who have strong professional associations that can (even if they do not do this)

provide their members with efficient support and turn-key solutions. In this case, whether the user chooses Windows, Mac, Linux or something else, they will find that the applications they need to use work correctly (or do not work correctly, if they make the wrong choice), without having to worry about installing or uninstalling anything.

This is especially the case for public administrations, and, above all, schools. Just like companies, they want a high level of stability and reliability, but unlike individuals, they can benefit from the high-level computer skills available in universities at a low cost for the government. This could be an opportunity to use efficient economical Linux-based solutions and to revive old computers with systems such as NewDeal. Instead of spending a fortune for the high-performance computers required by Windows, or in paying long-distance telephone technical support for proprietary solutions, the budget allocated to computer equipment for schools could be used for more useful things, such as supporting the installation of non-proprietary networks, developing specific solutions, etc.

It would actually be quite simple to put computers in our schools and spend almost nothing, using old 386 and 486 computers as Internet terminals.

Finally, there is a strong movement right now working to improve the user-friendliness of Linux. The first stable version of the KDE interface was released in July 1998 (http://www.kde.org) and the GNUstep project is moving ahead quickly. GNUstep is a free implementation of OpenStep, an extraordinary commercial system that I often use today. It was created by NeXT, the second company founded by Steve Jobs, the famous founder of Apple, who recently returned to that company, that recently bought out NeXT. OpenStep was renamed Rhapsody, and this was more recently included in the MacOs X. The major advantage of OpenStep is that user-friendly applications can be developed rapidly, while maintaining the advantages of having a real Unix system under the hood. Its availability as a free program, such as GNUstep, could be the missing piece of the puzzle that will give Linux, FreeBSD and all the other free versions of Unix a body of the same quality as their motor.

Would this also solve the problem of installation?

This is a different question: Windows, for example, is a system that is not as easy to install as Microsoft claims. An example of this would be the many problems that have been encountered by Windows 98 users (note 58). But these difficulties are usually hidden by the fact that the computer manufacturers “preinstall” Windows, which means they handle the complex job of configuring the computer for you. But no computer manufacturers preinstall Linux. So anyone who wishes to compare Windows and Linux is very disadvantaged by the fact that the installation process is visible when using Linux, but not with Windows.

In addition, since the arrival of Windows 98, there is no more free space available to install Linux as before, and you must be an experienced user to install Linux without erasing Windows. Let me try to explain this simply: you must know that a hard disk can be subdivided into several areas called partitions, and that previous versions of Windows were incapable of

using partitions larger than 2 gigabytes; this is why your new PC arrived with one 2 Gigabyte partition, containing Windows pre-installed, and some other empty partitions that you could easily use to store your data or to install another operating system like Linux without too much difficulty. Today, Windows 98 can use very large partitions, so your 6 gigabyte disk is now one large Windows partition, and to install another OS you need to reduce the size of the Windows partition, which is no mean feat, even if some programs, such as FIPS, can do this for you.

It is exactly for this reason that I developed the idea of preparing a Linux demo CD-Rom, which would get over this disadvantage: this way, it would be possible to distribute a CD-Rom so Linux could be run without installing it on your hard disk, simply and easily, in the same way that you run a Windows application. Students of the Ecole nationale supérieure have already gotten over most of the technical problems, and I am sure this project will soon be completed. In this manner you will be able to compare both systems, and see which one you like best, and then you can put pressure on computer manufacturers so they preinstall Linux together with, or instead, Windows.

How much economic influence does open source software have? Does it play a significant role in the computer industry?

Some serious studies have been made that give precise evaluations of the economic and strategic advantages that a company may have when using open source solutions (note 59). There are also several examples of European companies who have implemented these solutions successfully, and later exported them to the United States (note 60). Several large American banks depend on Linux to handle millions of dollars. Linux is used to manage warehouses for L'Oreal, to control gas station pumps and cash registers made by Schlumberger, to oversee the operation of elevators made by Fujitech, to run the corporate network for Ikea, and network computers for Corel. Well-known corporations such as Mercedes-Benz, Sony, Philips, Alcatel and Cisco use Linux. Some companies chose this open source operating system as an Internet/Intranet solution to replace a commercial form of Unix or Windows NT, while others use it to manage their corporate networks by replacing Novell Netware or Windows NT, and still others use it for their computer servers, application servers or office workstations.

An increasing number of industrial companies use Linux at the very heart of their products, such as elevators, Internet kiosks or robots. This is the case for the French company Lectra Systems, who is the world leader in computerized textile cutting machines. Lectra has been offering industrial solutions based on Linux since 1995, because, according to Pierre Ficheux, the company's systems development manager, tests have shown it to be "stable, efficient and inexpensive".

Companies using Linux are not, however, always willing to tell the whole world about it. Since this open source software is essentially free, many managers are afraid of it, and do not take the time to think about the real advantages it may bring them. In many cases, top management of these companies does not even know that they are using open source software. It is often the computer technicians themselves, who have ambitious tasks and limited budgets, who choose

Linux, sometimes without their top managers' awareness. If you have a tight budget and are required to use a "Microsoft style" solution, you may solve your problem by using Linux servers equipped with Samba: your boss will only see Windows NT, but you will save a few hundred dollars on each computer!

But this is the way things go in corporations: if something doesn't work, you will be better off covering yourself by having chosen Microsoft. The person in charge of special effects for Titanic knew that he was risking his job by selecting Linux, but the result has shown that he made the right choice (note 61).

Fortunately, this attitude is changing. Two things occurred in 1998, that most of the general public has not seen, but that may be signs of an upcoming revolution. First, to resist Microsoft's attacks, Netscape turned its flagship product, the Netscape Navigator browser, into open source software and its name was changed to Mozilla. Secondly, IBM, worried about the increasing market share obtained by Windows NT in the Web server market, decided to adopt and promote the Apache Web server: this is a high quality open source program that already has 50% of its market. In other words, two of the stars of the computer business — a Silicon Valley start-up, and the giant of the business — have approved the open source software model by their strategic choices.

It is doubtful that Linux will one day overtake Windows. But it is possible that the model for developing and distributing open source software is the one that will win out in the future. Because no company, not even Microsoft, is rich enough to fight against the assembled talents of the best programmers in the world. Especially if the result of their work is then endorsed by the industry's leaders.

But what is the motivation that drives these programmers? Is it possible to make money with open source software?

The very reason that open source software is of such high quality is that the driving force behind its development is not the money that can be made from selling it, but the desire to write programs that will be used by the largest possible number of people. Also, making the source code available means that the programmer's pride is at stake, that he will be judged by his peers. And what better personal satisfaction for a computer programmer than to have helped write a program that is appreciated, used, updated and improved for ten years by thousands of programmers and millions of users, all because it is a good program.

At the same time, the skills acquired while writing open source software have indisputable commercial value. What better experience to put on your resume, if you are looking for a skilled job as a computer programmer, than having made a significant contribution to an open source program that is respected by everyone in the industry? You see, open source software developers can actually earn a lot of money, even if they do not directly sell their programs.

An operating system can only gain ground if the environment is favorable. Microsoft's strength is partly due to the fact that there are many computer consultants that support its standards, along with tens of thousands of software publishers that create applications for Windows. Isn't this a serious hurdle for Linux?

Obviously, Linux does not yet have the industrial and commercial support that the Windows-Intel standard has. But let me start by refuting the specious argument that Linux is not credible, because there is nothing to guarantee its permanence. The history of the computer industry has shown that the permanence of a hardware or software standard is never guaranteed in any way: it depends neither on the size of its installed base, nor on the wealth of the company that promotes it, nor even on the technical excellence of the product! You can ask the early subscribers to the Microsoft Network about this. The good side of Linux is that, at least, it is the users that are controlling things.

Linux distribution is becoming more organized: companies such as Red Hat and Caldera are selling the program in stores, on CD-Roms, together with manuals and basic utilities. It will cost you from $30 to $40 for an unlimited number of computers. Compare this to the several hundred dollars for each computer using Microsoft's equivalent.

It is also wrong to say that there are no applications that run under Linux. Thanks to software publishers such as Corel and Netscape, who have decided to release programs for Linux, there are now a large number of applications available. And many other software publishers will follow. In addition, there are many sites on the Internet where you can download free and commercial software for Linux, that cover most professional needs: word processors, spreadsheets, groupware, Web browsers, database software, etc. (note 62) There are even free graphics programs such as GIMP, which is almost as good as the famous Adobe Photoshop.

Office suites such as Star Division's Star Office, or Applix' ApplixWare, are on the same level as Microsoft Office. While some specific needs are perhaps only answered by Windows applications, it is also possible to have them run over a network with Linux machines emulating Windows, using open source programs such as DOSEmu or Wabi, or commercial programs such as Ntrigue or WinCenter. If you need programs like this, you can also just keep one WinTel PC to run them.

As for technical support and commercial maintenance for Linux software, this is certainly at its beginning, but certainly does exist. Companies such as Pick System or the French company Alcove, have customers such as French research institutions (CNRS, CEA) as well as many large corporations (L'Oreal, Philips, Alcatel). In addition to commercial technical support provided by distribution companies, and maintenance support provided by computer consulting firms, Linux users can always count on the legendary solidarity of the community of users, through Internet newsgroups such as comp.os.linux.hardware or comp.os.linux.setup. Linux also received a prize from Infoworld magazine for the quality of its technical support. One cannot say the same thing for Microsoft.

What attitude have different governments adopted with respect to open source software?

I am always amazed by the refusal of our political leaders to face the facts on these issues. For some of them, computers are just a technical subject that is in fashion these days, but not very interesting, as if all that counted was selecting the brand for your word processor! And those politicians who have understood what is really at stake in the information society are often merely hoodwinked by the propaganda of software companies.

The first thing to consider is that governments could save a great deal of money by selecting open source software. To have a better idea of what is at stake financially, look at the case of a university near Paris that recently purchased 15 personal computers to install Linux. No one knows exactly how much computer manufacturers pay for Windows 95, but it is probably around 500 Francs (less that $100). If the vendor makes no profit off this (which I doubt), this means that the university had to spend 15 times 500 Francs, or 7,500 Francs for a product that it did not want. Basically, this was a gift of 7,500 Francs made by the French government to Microsoft. If we extrapolate this example to all the similar establishments in Europe, and to all the different public administrations, we can see that governments are wasting millions of dollars to subsidize an American company, whose European subsidiaries are no more than distributors, and, on top of that, a company that is far from needing this money to survive.

This would be a unique opportunity to obtain a bit more freedom from the technological monopoly that is held by unscrupulous multinational corporations, and to give our companies and schools a very important strategic advantage. What we need to do is to convince computer vendors, such as HP, Dell, IBM, Gateway, Compaq etc. to stop acting as Microsoft's tax collectors, and start offering users PCs where this tax does not have to be paid. In France, after a very long effort from universities, this is starting to come true: at the time of publication of this book, HP and Dell have begun offering such an alternative (to universities only, unfortunately), and Dell is offering a similar possibility in the US.

How should Europe respond to these questions?

It seems to me important that Europe quickly develop an active and independent policy concerning computers, and information processing in general. It certainly has the technical means to do this, because Europe has skills at the same level or even better than those found in the United States. European computer research centers are at the forefront of formal software verification development methods, that have made it possible to realize many important projects, the latest of which was the second launch of the Ariane 5 rocket.

What is lacking right now is real political will: a manifestation of this could be the creation of a European agency for open source software and open standards. This could be made up of scientists who share the ambition to help the cooperative efforts of the Internet community, and build a high quality open platform for interoperable computer systems. The European Union could use such an agency to help existing cooperative developments around open source

software and open standards. This would only require a few million dollars (which is nothing compared to the European budget) and would make it possible to quickly finalize strategic projects such as the GNUstep interface presented earlier (note 64), to favor the development of an infrastructure for information exchanges inside the European Union, and to create a high level network that could be a catalyst for the creation of modern, free, open and dynamic computer systems.

Only an initiative of this sort would make it possible for Europe to organize its computer industry, that is, its fate, while helping develop value-added jobs in these sectors. It makes me sick when I hear Microsoft giving us lessons such as: "crack down more on software piracy, that's what will create more jobs in the computer industry"! (note 65) Since when has the development of Microsoft software — that is entirely done in the United States — created any real jobs in Europe? And before giving lessons about piracy, it would be a good idea for Microsoft to start reimbursing Windows licenses that are imposed on so many users who don't want them.

The choice of a free, open system would have the effect of eliminating the information tax that is collected by Microsoft, making our companies more competitive and helping reduce unemployment. Because these tens of millions of dollars that only end up in the pockets of Microsoft or its fellow software companies could be spent on productive activities, such as financing maintenance contracts with local computer service companies, who could adapt hardware to fit the specific needs of companies. This could create a real opportunity for expansion, fostering growth and helping create skilled jobs for engineers who would be responsible for the quality of their products, and not only for sales people who are trying to sell products they have no control over, and whose profits end up returning to Redmond.

Let me say clearly that there is no conflict of interest between Europe and the United States on this subject: what is at stake is open computer standards, and the risk of seeing a monopoly extend its control over all of the links in the information chain; these stakes are the same for everyone, no matter where the monopolistic company is located. This is a challenge that concerns all of mankind.

Unfortunately, it seems clear from current political discourse that politicians will not be the ones to change this. This collective awareness will only come from public opinion, from the computer community, and from citizens all over the world. From these millions of computer users who have been marginalized, manipulated and held in contempt up until now by Microsoft. Perhaps one day they will be fed up with being treated like cash cows and guinea pigs, who are considered just good enough to keep quiet and pay for software that doesn't work correctly. And this would then be the serfs' revolt.

Would you go as far as saying that our passiveness in dealing with Microsoft is a hidden, tacit societal choice?

Without doubt. The Linux adventure, for example, brings to mind three words that you are familiar with: liberty, equality, fraternity. But the Microsoft adventure, as you have probably understood by now, presents a society that, in my eyes, would be closer to servitude, inequity, feudalism. Computers are now giving us the possibility of drastically changing the way we live our daily lives. But with this opportunity, there is no such thing as a free lunch: the only way you will find anything in this information society is if you bring it yourself. If we continue letting Microsoft build it, it may end up looking like a nightmare. It is therefore up to us to choose whether this revolution should lead to a technological dark age dominated by a handful of feudal lords who take control of the means of creating and transmitting information to collect taxes each time we communicate with each other. Or, if we would rather live an open and modern world, built around democracy and decentralization, where the free flow of information allows us to benefit from the huge potential of borderless cooperation and shared knowledge.

Glossary

Application: Software program dedicated to a specific activity (financial management, game, word processor…)
Betamax: Video tape recording format used on 1/2 inch video cassettes, developed by Sony in 1975. It was beaten in the market place in the beginning of the 1980s by the VHS format.
Bit or bit: Abbreviation for BInary digiT. A basic unit of data, which can have one of two values: 0 or 1. This is also used as a unit of measure for the capacity of some computer components, electronic devices and storage devices.
Browser: A program allowing users to "surf" the Internet.
Bug: Programming error in a program.
Byte: Unit of measure for data equaling 8 bits.
CD-Rom (Compact Disc-Read Only Memory): An extension of the audio CD, containing the same physical characteristics. This compact disk, which can contain data of any kind, was designed for use on computers. It can be consulted on a computer with a specific (internal or external) reader. Originally used by professionals as an auxiliary storage device, the CD-Rom is now a medium used to store and distribute software to the general public.
Chip: Common term used to designate integrated circuits (memory, processors…).
Click: Press on an input or control device (mouse, trackball, remote control). Clicking on an icon is a way for the user to end simple orders (ex.: open or close a file) to a computer using a GUI, or graphical user interface.
Client: In computer networks, a client is the computer that receives data, as opposed to the server that sends data.
Console: Electronic device connected to a television set, used to run multimedia programs. Video game consoles use 8 bit, 16 bit, 32 bit or 64 bit chips, in increasing order of power.
Cookie: A data file used to store information about a netsurfer that is sent or received by a Web server, enabling it to identify the user and reconstruct a history of the different sites that this person has visited on the Web.
Cyberspace: Term invented by the American science-fiction author William Gibson in his novel Neuromancer. By extension, this term is used to designate the world of communication that is found beyond the user's terminal (computer, telephone or interactive television).
Digital: Data that has been coded as a series of bits, which are 0s and 1s. The digitization of data — its translation into a series of bits — makes it possible for it to be mixed together and processed, and has therefore made the existence of multimedia possible.
E-mail: Message exchanged between two computers, connected by modems to a telecommunications network (usually the Internet). This may also contain multimedia data.
Free software: See Open source software.
GUI (Graphical User Interface): Graphical interface used on computer programs.

Hacker: Traditionally, a high level programmer who knows how to enter into and manipulate complex computer systems. Unfortunately, this word is also used sometimes to designate pirates.
Hard disk: High capacity storage device used by computers.
Hardware: Term used to designate all the physical equipment used by computers: CPU, hard disk, modem,… as opposed to software; applications, programs.
Hypertext: Text containing cross-references to other documents (which may be multimedia documents). It is usually read with a browser, that indicates the links using colors, by underlining them or by using some other graphical indication. Users can click on these links to obtain additional information, or to go to another document. This makes it possible to organize several paths of access through a set of information.
Icon: Graphical representation showing things that can be clicked on — in user-friendly interfaces — to select files, open them, save them, open applications…
Interface: The user interface is the part of an application that is used to communicate with the user. It handles the interactivity between the user and the computer.
Internet: World-wide computer network, made up of more than thirty thousand interconnected sub-networks of various sizes, and that counts more than sixty million users. The Internet can be used for many different types of activities: exchanging e-mail, participating in any of the tens of thousands of Usenet newsgroups, or surfing the huge World Wide Web.
Intranet: Internal, private, corporate network, connected to the Internet and using its protocols.
Java: Programming language designed by Sun Microsystems, making it possible to write applications that can be run on all types of computers, regardless of their architecture.
Linux: Operating system that is an implementation of Unix created in 1991 by the young Finn Linus Torvalds; Linux is the emblem of open source software.
Memory: Device or medium used to save and restore data. There are two types of memory: RAM or Random Access Memory, that can be read and written indefinitely, and ROM, or Read Only Memory, that cannot be written to, but in the general sense it can be any device that can hold data in machine-readable format. Computers are often described by the size of their memory (the RAM used to process data), and the size of their hard disk.
Microprocessor: Processor whose elements are miniaturized in integrated circuits. The central processor of a computer is, in a way, the computer's "brain": it processes the instructions of programs that are stored on the computer, including those of the operating system.
Mouse: Computer input device used to interact with a graphical user interface. A mouse contains a ball that makes it possible to move the cursor around on the screen, and one or more buttons that are clicked to trigger actions.
Multimedia: Communication technique using several digital media together: text, graphics, photos, video, sound and data, that are then presented simultaneously and interactively. The development of multimedia has been made possible by the digitization of data.
Net: Abbreviation for the Internet.
Netsurfer: Internet user.
Online: Online networks or services are those accessible from a terminal or computer.
Open source software: Programs that are usually created by collective efforts of hundreds of programmers around the world, and freely made available to the community. These programs

are distributed under a special license that prevents them from being used for commercial purposes. (Also called free software)
Operating system: Software layer used to control the hardware and provide a high level interface between applications and the different components of the computer.
PC (personal computer): This expression, that was originally used to mean any personal computer, is now used to designate IBM and IBM-compatible personal computers.
Pirate: Term used to designate a person who illegally breaks through computer, electronic and/or telecommunication system security codes. Pirates are also people who make illegal copies of software, even if many computer experts, including Richard Stallman, consider that this is a totally unjustified use of the term.
Reboot: Restart a computer, usually because it has "crashed".
Server: Powerful computer used in a network to receive orders from "client" computers and process them. In online services, content is stored on servers.
Software: Data and intellectual creations that are not part of hardware. Programs, applications, procedures and protocols are software. By extension, this includes anything that is "content" (books, movies, disks, CD-Roms), as opposed to hardware.
Start-up: Small technological companies, usually created, or "started up", to develop and sell a specific product.
Unix: Multitask and multi-user operating system initially developed by Bell Labs in 1969. There are several flavors of commercial and free Unix.
Vaporware: Commercial practice that consists in announcing that a new program or hardware device will soon be released, in order to handicap competitors' products.
VHS (Video Home System): Video tape recording system created by JVC and Matsushita in 1976. It won out over Sony's Betamax format. All general public VCRs and videotapes today use this format.
Virus: A computer program that searches out other programs and infects them, sometimes damaging them permanently. Viruses can reproduce themselves, and can be transmitted to other computers by contaminated floppy disks or CD-Roms, as well as online communication.
Windows: Graphical user interface program developed by Microsoft as an addition to its MS-DOS operating system.
Wintel: Commonly used term for computers using the Windows operating system and Intel chip.
Workstation: Powerful computer used by professionals, as opposed to personal computers used by the general public. Graphical workstations are dedicated to processing graphics (desktop publishing, computer-assisted design, 3D images…).
World Wide Web (abbreviations: Web or WWW): Popular multimedia layer of the Internet, which can be explored using a browser, and which is very user-friendly, thanks to its hypertext links.

Notes

Introduction
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