

Thinking out of the Box

**A Vision of the Future with respect to
Organization and Technology**

Hans Appel

Design: CommPlot in communicatie, Zeewolde

Illustrations: Hans Kennis, Joep van Opstal

Translation: Vinder Hunspal, The Localizers, Amsterdam

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Our field is still in its embryonic stage. It's great that we haven't been around for 2000 years. We are still at a stage where very, very important results occur in front of our eyes.

- Michael O. Rabin

Contents

Foreword
Introduction: A turbulent world
So what's new?
The 'dumb' computer
From automobile to mobile
Smartcard
iButton
Discontinuity or radical changes? Consequences for IT
Network Computing (1+1+1+1+... = a lot)
The Network trend
How? Java as the catalyst
The Network economy

Mode-rn business management and eCommerce
The marketing approach of eCommerce
Reliability and availability
Strategic IT solutions
What can go wrong now? Pitfalls and excuses
'Out of the Box'
Literature
Notes

Foreword

The end of a century. Indeed, the end of a millenium. A time of doom-mongers, but also of visionaries. A world at maximum acceleration. Changes are being made faster than ever. What's next? Of course, this is not about the technology itself but what you can actually do with it. In the process, however, is it now taboo to keep using the same technology after set periods of time? Is this also the case for people who do not use the technology on a daily basis?

I am regularly asked to give presentations about our vision on the changes occurring around us and the role that technology plays in all this. 'Our vision' is in this case, the vision of Sun Microsystems. I've noticed that I'm rather reluctant to talk in depth about technology. As if it's something you use, but not something that you talk about. Discussing the application of the product is ok, but not it's nuts and bolts. I find this rather unfortunate. I'm one of those people who feels (and knows) that technology is of considerable importance and that one should be able to talk about it. I see it as a challenge to explain technological concepts to 'new' audiences.

The intention of this book is to provide a snapshot of a sector in motion. A 'freeze-frame', I guess, would be the modern term for it. But just like it always is when you try to capture any fast-moving scene on film, some parts end up vague and blurred. That, unfortunately, will also be the case here. This narrative does not presume to be all-encompassing, however, it does give a good impression of what is happening in the information technology sector, as seen by yours truly. In this book, I have drawn richly from recent works of both management and technology gurus, who can relate these issues much better than I ever could, and I hope that after this initial introduction you will turn to them for further details.

Hans Appel

October 1998

This booklet is a “living” document. So in the second edition text additions are made to keep the information as up to date as possible.

Hans Appel
November 1998

Introduction

A turbulent world

Of course, it is an optical illusion, but if I didn't know better, I would say that the earth is spinning faster and faster. Changes occur at record speeds. It's like a train with technology as it's engine. Locomotive and push-cart at the same time. We are seeing great changes in such divergent fields as (international) competition, society, and leadership.

Competition

Competition is no longer as comfortable as it used to be. Just a decade or two ago, there were large, well-established companies that did not fear any competition. I recently came across a fitting description that went as follows:

Large companies can often be likened to large, luxury sedans driving on clear, open highways. A nice, straight long lane. In their rear view mirrors, these companies see black dots (the competition) in the far distance, which for years never get any bigger. These organizations have even become so arrogant and self-satisfied that they have put their luxury sedans on 'cruise control' and have not realized that the world around the highway is changing. Suddenly, they realize that a little black dot behind them has suddenly become very large and, worse still, threatens to overtake them at great speed. And, on the heels of that dot come many other dots. The sedan is no longer on its own. From every access road come small cars driven by entrepreneurs. The highway becomes increasingly busier and the world takes on the appearance of a race. Fast reactions are now called for.

Society

Society as a whole is also in a state of change. It used to be that the government, law, education, the church, family, and unions determined the structure of our society, order in our society and the rules for our society. Today that is no longer so.

Where once the emphasis lay on land, capital and/or labor, we are now becoming a society for whom the emphasis rests on knowledge.

Today's society is directed toward the individual. The individual and his knowledge. But what does that entail? How does it work? What does it look like?

Alvin Toffler¹ talks of 'Terra Incognita', the uncharted landscape of tomorrow, which no longer concerns land, money or raw materials, but content: intellectual capital. In the mind and stored on systems. Digital, in bits and bytes.

Toffler indicates that the future is no longer linear, no longer a continuation of the past, no longer predictable. No, the future is chaos, the future is a series of discontinuous, radical changes.

Peter Senge² suggests that we must stop basing our decisions on the past; stop deciding by 'looking back'. Michael Hammer³ adds rather pithily, "If you think you're good, you're dead!" In short, the formulas of the past are not the formulas of the future, and organizations will need to keep that in mind.

Leadership

As we grow in intellectual capital, we will need a different type of organization than that of the present, industrial orientation.

The new organizations will need to be self-learning. Organizations are, and form, a distributed network of ideas, and in the future they will function as 'exchanges' of knowledge and ideas, with people inside and outside the organization working and looking for new opportunities together.

C. K. Prahalad⁴ thinks that we will have to prepare ourselves in a different way for the 21st century than we have done up until now with our organizations. Previously, the approach was often one of, "On your marks, get set, get smartthen what?" In other words, the emphasis was on reacting to present problems. No thought, in general, was given to the imminent dawn of the 21st

century, an era that demands new markets, new methods, new industries, and new rules. An era that requires an attitude of 'never being satisfied with the status-quo'.

The structure of organizations needs to change. We must no longer think in terms of hierarchical organizations, no longer in terms of organizations that function 'top-down' according to the organized "fear" model. We need leaders who can decentralize power, who can democratize strategies, who feel comfortable with discontinuity, and who through all that see new opportunities. Warren Bennis⁵ describes them as, "People with the future in their bones!" And we, the technologists, make it all possible. We create the conditions that support the changes around us and that make doing efficient business possible.

Realization of the future: consequences of IT...

The present state of affairs in the area of information technology already enables us to lift the tip of the veil of 'doing business in the 21st century'. The Internet is causing country-borders to blur, and business can now truly take place on a world scale. The entire world is the market. The communication potential is great but the consequences remain to be seen. Issues such as the number of users of a particular technology, network loads and so on are very unpredictable.

So what's new?

Let's take a look at some of the technologies and developments that are drastically going to change the world scene. Items such as 'dumb' computers, 'smart' cards, intelligent 'buttons' and mobile communications come to mind.

The 'dumb' computer

The advance of the 'dumb' computer is a fact. After all, the world does not only have computers with monitors and keyboards, but many other types of computers besides. These computers, which are often no more than a simple CPU, do 'dumb' things. They announce, for example, "I'm cold", or, "I'm half full", or "Two people passed by in the last five minutes."

Then there are the computers that are built into our cars, which also average around 30 or 40 items.

If we can agree, in general, that computers will work more closely together in the future and that this will take place through them being connected to each other via networks, then it is clearly possible that these 'dumb' systems will also be 'connected'. The interconnection of all kinds of different computers offers an unbelievable range of new computerization possibilities. Possibilities that will radically affect our daily lives. If we then also consider that 'connecting to a network' actually means being available over the whole world then, in essence, many functions will be available everywhere and always. After all, the world is only 1/8 of a second 'away' over the network (and, for that matter, comes no closer than 1/8 of a second).

Let's look at what could happen with your car, say in a number of years from now. Don Peppers⁶ provides an interesting example in his book *Enterprise One-to-One*.

The Car of the Next Century Many dumb make one smart

The car of the next century will recognize you by your voice and weight, and will immediately make all kinds of adjustments that will facilitate and increase your personal comfort. For example, the position of the seat, the air conditioning, the angle of the mirrors, and even the setting for your favorite radio station. Because you are 'you', even the shock absorbers will adjust to your personally preferred level. Whether you're the type who likes to feel some contact with road or whether you'd rather glide on a cushion of air, the settings will automatically change as you step into the car. It's all a matter of how you want to drive.

Once you are on the road, the car will record how you drive off and how you stop, how you drive round bends and how you accelerate and brake. With the help of all this information, the fuel supply and timing can be set and adjusted to your particular driving style and habits, so that the car can perform as economically and as safely as possible by day or by night, on dry roads or wet, on highways or on local roads.

When you want to change any of these personal settings, you would say, for example, "This is the way I would like to have this set", or, "Adjust my seat to this level because I'm wearing high heels."

The car could be connected, via remote communication, to your dealer and to your home PC. If the engine had to be adjusted, or if a part was on the verge of breaking down, then a connection would automatically be made. Your agenda and the workshop schedule of the dealer would be compared. You would then receive three alternative choices for making an appointment. In addition, your car could be connected to a GPS (Global Positioning System) that would keep you continuously informed on, for example, where the nearest French restaurant is or, what the fastest route to the nearest airport would be, taking into account all the other traffic tracked by satellite. You could, if you wanted to, provide your insurance company with a chip (in the form of a Smartcard or an iButton), which would demonstrate your calm driving behavior and your compliance to speed limits, in order to become eligible for a lower premium payment.

All this will be available virtually everywhere within the next ten years. A number of automobile manufacturers are already busy experimenting with parts of these systems.

In short, the everyday appliances around us will soon be able to recognize us and anticipate our personal needs.

User interfaces of the future

It's probably clear that we still, as yet, cannot speak of having an ultimate technology-user interface. Nevertheless, there is always the need, to a greater or lesser degree, to keep oneself informed about computers in order to operate them more meaningfully. We do, however, already know that user interfaces must satisfy three conditions: they must be simple to operate, versatile enough for many different applications, and be fun to use.

The graphical user interface (person-technology interface) designed by Xerox Parc some twenty years ago was an absolute revolution. Apple Computers took this approach and commercialized and popularized it further with their Macintosh system. It was Microsoft who eventually got the whole world acquainted with the graphical user interface through their Windows 95 product. Still, I venture to state that this approach is already obsolete.

The Macintosh of today is, of course, no longer the Macintosh of 1984. Such an interface also evolves and that means that things become considerably more complicated and cannot always be readily understood and applied by the 'naive user'. The same is true for Windows 95, which is again a product that the average non-technical user would find quite non-transparent and complicated.

A modern approach to the user interface problem is to use speech technology. Now, that's easy to say but not easy to do. Speech technology is one of the three branches of applied artificial intelligence. The other two branches are expert systems and robotics. Expert systems are systems that can reason. That's somewhat different from 'calculating', the purpose for which most of our present day computers have been made. Reasoning means: to be able to establish logical inferences. In a way it is to 'roughly' determine something which, of course, is in contradiction to the precise way in which we always use our computer systems. Soon, however, the combination of speech technology and expert systems could offer some solace with the design of a completely new interface between people and machines.

Speech technology means that the computer has to 'hear' what is said. It also means that the computer sometimes has to function speaker-independent and at other times speaker-dependent. We can talk of speech-to-text systems which convert speech into digital information in the form of text. Experiments with such systems have long been underway, and they have even been applied already. But for the purposes of a person-technology interface this is just one side of the problem. After all, I also would like the computer to 'understand' what I say; that the computer makes the right inferences. For that purpose we again need expert system technology.

Let me provide an example of what we are aiming for:

Imagine that I want to write a memo. What I do NOT want is to have to speak to the computer in the following monotonous manner, "Open, MS-WORD, File, New", and so on.

What we're doing here is using speech technology as a farce. We are not using a mouse or a keyboard, but we are using the same 'command structure'. For the person-machine interface nothing

has been changed except the use of another operating system. But I still must deal with non-transparent menus and other command structures.

What I REALLY want is to be able to say to my computer, "I want to write a memo." To which the computer would respond by running my favorite word processing program and have it ready and waiting to receive the text of the memo.

A lot more intelligence, however, is needed for all this. Apart from converting speech into digital text, interpretation is also needed here because reasoning is taking place. When we look back to the description of the learning process of the intelligent car, we can see that it is possible that these systems will also learn how the user works with his or her computer: what the user starts up in the morning on arriving at the office and what applications he or she will use.

The next step, in this modern user-technology interface example, is that once the word processor is ready to receive the memo, then the memo could just be dictated in such a way that it would require no further edits or checks after the dictation.

And while we're still on the subject, consider yet another aspect: if the computer hears us and the machine can convert the spoken words into digital text, then it should also be possible, using existing translation techniques, to convert the digital text from one language to another. So, to reason one step further, I could ask the computer to read out the memo (text-to-speech) in the other language. In other words, one would also now have a translation computer on hand, whereby interpreters would no longer be needed.

Emotional intelligence

Another branch of the technology-user interface involves emotion. When we communicate with other people, we do it with emotion. We nod our heads when we mean 'yes'. We respond to the mood of the person we are communicating with. Is the person in a less favorable mood, then we are careful about how we communicate with them. Computers must, therefore, also consider emotions. In this respect we can then talk of computers having an 'emotion quotient' (EQ).

By recognizing emotions, computers could anticipate and respond to the mood of the user. In doing this, communication could be organized more effectively, thus enabling us to achieve our goal more easily.

This would also be the case when using appliances that we do not immediately identify as computers. Let us use the car again as an example. When the driver of a car gets angry or aggressive, his behavior on the road is clearly different than when he is in a calm, amenable mood. If the car could establish the emotional state of the driver, then the car could take this into consideration and, for example, warn the driver earlier of any risky situations.

Along the same lines, emotion is also a factor for communication from machine to the user. Remaining with the above example, imagine that a risky situation arises or that one already finds oneself in such a situation. Let's say that audio is used as a warning system in the car. A warning in a very dangerous situation would then have a different tone frequency and volume than that when driving on a long, quiet road.

If we establish that emotion must play a prominent role in the design of user-friendly user interfaces, which everyone can work with, then it is clear that too many keys, (large) screens, and graphical windows could emotionally frustrate the average user by the sheer overload of information. There would, in that case, be no question of natural use, of a natural extension of the user, of an interface whereby simplicity has been introduced at the expense of complexity.

That's why systems that are used in the home should form a part of their natural environment. This means, for example, that in the living room or study they should, for example, look like 'desk lamps' which when switched on reflect virtual interactive pictures.

This is not just some future fantasy. An example of a first step in this direction is the so-called PC-lamp. This apparatus combines a traditional desk lamp with a projection device. Activated by voice, touch, or automatically when important messages come through, the lamp projects a virtual screen on the desk top. The form of the virtual screen changes according to the operation to be carried out.

The system accepts the human voice for commands, dialogue, and dictation, but it also recognizes signs. By using a video camera, the system further interprets finger and eye movements and also facial expressions (emotions!). Besides this, it also recognizes gestures and other previously established indications of emotion. Further, the position of the display adjusts to the users head movements and his field of vision.

I would like to state that this is no science fiction. The PC-lamp won the "Byte's Best of Show" prize during the Cebit 98.

A product of some distant future? I do not know. Software companies are already bringing such systems and the building blocks for such systems on the market. Here and there some faster hardware is still needed, but that's just a question of time!

From automobile to mobile

There is a great clamor for mobile devices. Devices such as those we now use in mobile telephones, mobile personal digital assistants and so forth, which have functions that can be combined into 'information appliances' - like some information 'toaster' which everyone can operate and which everyone can use meaningfully.

Mobile communications

What is often hidden from the attention of the greater IT consumer market, are the developments in the area of mobile communications. That's a pity because such developments indicate that the clamor for mobile devices will make tremendous breakthroughs in the short term.

In the past we were condemned to use geo-stationary satellites that orbited at around 36,000 km above the earth. That was rather annoying because we had, on account of the great distances, to contend with considerable time delays (a quarter of a second), and ground stations required substantial resources to be able to access the satellites. Nevertheless, they do cover a large part of the earth per individual satellite. New projects, developed along totally different lines are now in the pipeline, and are expected to be in operation before the end of 1998.

An example:

Motorola has an Iridium project in which 66 satellites will be launched in a so-called Low Earth Orbiting (LEO) trajectory of 780 km. Each satellite has 48 antennas which can be directly accessed from earth.

What is the general background of this approach, one may wonder.

Well, firstly, the satellites are much closer, whereby we are released from the infernal time delay. Secondly, people want access the satellites directly, without the intervention of any ground stations. Now that's not really a simple matter because the power that is used per apparatus on earth can be no greater than 1 watt. The reason for this is that we don't know what the consequences would be for body tissue of having larger power sources at higher frequency bands next to our bodies. We take a certainty for an uncertainty and thus we keep to the 1 watt limit.

One solution would be to launch and maintain satellites with large antennas. That, however, is not technically feasible at present. That's why a number of smaller antennas are used per satellite. In the case of the Iridium project there are, as already mentioned, 48.

Another characteristic of these type of satellites is that the speed with which information is processed is relatively low. The satellite solution mentioned here is, in principle, meant for voice communication. The technology for this is digital and uses 8,000 samples per second. We know that a byte consists of 8 bits, whereby the speed is thus $(8,000 \times 8 = 64,000)$ 64 kilobits per second. Keep that figure in mind: 64 kilobits per second. This namely means that not everything in the future will be as fast as 3 megabits. This knowledge will only come in handy later with the development of programs concerning the 'thin client' phenomenon.

Still other examples of mobile communication projects that are in the pipeline are:

Loral and Qualcom who are working together on the Globalstar project in which 48 satellites will be launched in a LEO trajectory.

The Motorola Celestric project, which will be a hybrid network consisting of a combination of 63 LEO and 9 geo-stationary satellites.

In short: it's a serious business with initial results expected already before the end of 1998.

Smartcard

In the framework of the new technology and the use of this new technology by a much broader market, Smartcards also need to receive attention.

Problems with the present type of credit cards are legion. Such cards are often only used for one type of application or for one organization. No firm agreements have as yet been made to create standards. People don't just want credit cards for debit or credit applications, but cards that provide combined functions such as, intelligence identification, loyalty programs, insurance applications (healthcare), Network Processing, etc. These are the kind of issues that organizations such as Visa, Citibank, Siemens, GemPlus, etc. are investigating at the moment. The limitation is the 25mm² space that is physically available to place a chip on. After all, not only does the CPU and memory use this area but speed and storage capacity are also constantly battling for this space. The challenges are still enormous: on the one hand we can, in an intelligent way, improve security, but then on the other hand, the exchange of information and applications from individual cards again puts pressure on security issues.

One thing is certain: customer-friendliness is a priority when using a medium such as Smartcards. When designing applications we always have to take into consideration fast (acceptably fast) processes. But, in this framework, the issue of use by the 'naive user' is also of significant importance.

iButton

Another splendid development is the so-called iButton. This technology allows us to build a Java processor and memory in a 'button', a little box that is not susceptible to water, acids, or gases, etc. This button can be mounted for example on a ring (to be worn on the finger), on a watch, a money clip, a key chain, but also on various appliances. The potential that could be obtained through this approach is unprecedented. Communication between an iButton and the network takes place using a sensor that is simply connected to a workstation or a PC.

The iButton is an example of a type of computer that is worn ever closer to the body. We still sit a couple of meters from the TV, about 70 cm from our PC monitors, and a portable telephone already touches our body. A ring with an iButton, however, rests on our finger - thus on our body. Before long we could be carrying technology inside our bodies - which for people having a pacemaker is already a fact. All this requires extra reliable characteristics. Characteristics which the IT professional hardly heeded in the past.

Biometric verification

With the help of the iButton, systems can be made that use so-called biometric verification. Biometric verification looks at human characteristics such as the voice, finger prints, and handwriting. This information can be digitally stored in an iButton and is used for the identification of users. Future devices will not just recognize the specific individual but also the context in which he or she operates. This digital information could also be stored in the iButton.

Let me give an example of the application of an iButton in a key chain that was developed and implemented in The Netherlands. The goal was to encourage people to think of ideas how this kind of, previously unknown, phenomenon could be used. The iButton program was developed to support a PR campaign which had a golf tournament as its first event.

Everyone who registered for the tournament received a key chain with an iButton. Each participant was asked to go and apply the iButton to the sensor of a nearby workstation and, by searching and clicking in a previously recorded list of participants, identify themselves. In addition, a number of questions were asked about each person's golf game. Did they take risks? What distance could they reach with a number 5 iron? What was their handicap? Etcetera, etcetera. In short, the person's golf profile was determined and recorded on the key chain.

During the game, a number of workstations, furnished with the necessary programs, were set up along the course to provide information on how to play the next hole based on the information profile stored on the key chain.

The data was further used as a source of information in a later stage of the PR campaign, as all information about visiting subsequent events was stored in the iButtons of the participants, to be released and used again later.

Discontinuity or radical changes: consequences for IT

From the above examples it is clear, that if we agree that this is a view of the future, then we are talking of a series of discontinuities that will take place. We in the IT industry are not used to anything else. Technology is characterized by shocking innovations emerging every now and then and reducing existing products and services to worthless items in one stroke.

Our industry is well-known for its entrepreneurs and the occasional startling growth of unknown and often, in the first instance, insignificant companies. This discontinuity, this total renewal of an already satiated world, and these totally new technological possibilities are right up our street. However, this time it looks like we need to satisfy 'the question' and not, as in the past, create the question itself.

Shock waves

It looks like we computer engineers have been awakened with a shock. The millenium-problem (Y2K), the introduction of the EMU, the potential impact of such issues on our computer systems and, of course, the eventual result of years of making excuses and writing incomprehensible 'spaghetti code' (undocumented, confused jumbled code) have caused this shock.

All computer engineers feel it now in their bones: here we go again. Compelled or not, a new vigor has come into existence. We can celebrate the fact that 'funnel' thinking has been pushed aside and creativity again rides rampant. Suddenly knowledge, skill and experience again have value and are put to use in keeping with their worth.

We understand from investigations made by Forrester Research that there is also a 'Third Skill', a new trend that carries within it three kinds of knowledge: *knowledge of IT* in the area of databases, transaction systems, content management and components; *knowledge of marketing* which has to do with brand names, creating awareness, content creation, integration of distribution channels, and communication, and *knowledge of business* which concerns sales processes, legal aspects of commerce, and sales channels.

People who can handle all three knowledge areas are known as the 'third power'. The Third Skill not only concerns the specific knowledge of details but it also involves bringing the different disciplines with their own specialties together, followed by cultivating an understanding of the goal to be attained, and finally creating the result through combining and coordinating.

It's a joint effort - just as a film producer does not write the script, shoot the film, direct the set, and also act the leading role, all on his or her own.

Network Computing: (1+1+1+1+...= a lot)

The Third Skill network is a way of working with which we will become increasingly familiar. What is notable is that it looks a lot like the approach followed by 'the intelligent network' which involves the decentralization of power and self-learning organization models.

Network Computing in essence means: place the intelligence where it belongs, give the user interface - the user/technology connection - the correct priority, and build systems for the 'naive user'.

The traditional IT approach consisted of offering four or five rigid, inflexible applications per end-user where just a few dozen or at the most a few hundred end-users were involved. This kind of 'transaction'-oriented system was actually still used in the client/server age. We said that the client/server approach was new, but that's far from the truth. We have tried everything: large servers, small servers, large clients, small clients, but actually we change very little of the systems themselves. We did not exactly know where to put the data or how much data to put where. The same was true for the logic. Where and how much? We saw the interface with the user as being the least important consideration. And when we realized that this connection was actually of considerable importance, the existing user-friendly connection (Apple Macintosh Finder or Windows 95) had in the meantime evolved to such an extent that there was no longer the question of simplicity.

The new IT approach, the Internet/intranet approach is actually of quite a completely different order than what we have been used to in the past. Here we have a dozen dynamic applications that

individual users can implement themselves. Users can investigate new areas and store the results in 'user profiles', or whatever we want to call this phenomenon. And with this the unpredictability factor increases, whereby the discontinuity principle is satisfied. Unpredictability as to the required calculation or communication power. Indeed, a marketing campaign could raise the number of Internet/intranet requests, or 'hits', to be dealt with from a few hundred to a few million within two days. It could remain a week at that level, and then fall back to the 'old' level within a day. For such purposes a different kind of technology is needed than that found in an average PC!

If we look not only to the professional user but also take stock of the 'naive user', the 'browser interface' could well become the interface of the future. For that matter, we could also ask when is a user 'naive'. Does it have to do with the profession, with experience, or knowledge?

With this new IT-approach we will be handling data, logic and user interfaces in a completely different way. Here, we are referring to 'Network Centric Computing' and other ways of thinking.

This has its consequences.

To begin with, when using Network Centric Computing I don't know what kind or type of computer is connected to the network. The 'Gestalt' of the client can be a PC with a 480 x 640 monitor, but it can just as well be a workstation screen having 1280 x 2560 pixels, or even a Personal Digital Assistant (PDA) in the shape of, for example, a PalmPilot with a tiny 120 x 240 pixel screen.

And then we still haven't mentioned the type of processor that would be used with these different systems.

Think also about the network speeds that would be required for this concept.

At this moment, it is easy to say that we use an intranet so that we have control over the speed and load of the network. But the essence of Network Computing and the new technological approach is precisely that all these factors will become increasingly unpredictable. That's why it's best to assume that in the near future we will continue to have to deal with low transmission speeds. The well-known 'last mile' concept. Or think back to the section about mobile transmissions (see page XX).

The 'last mile' concept assumes that the existing infrastructure of cables that run into our homes, will remain for a long time to come in the form that we know them, namely copper and coax. Both media can transport digital information at considerable speeds, but would first require some adaptations to the existing hardware. These adaptations would require substantial investments and, therefore, will probably not be undertaken on a wide-scale within the foreseeable future.

I have already pointed out that at this moment enormous financial investments are being made in satellite networks. These investments need to be recovered within a period of 10 years. With that we can add that the speed of digital mobile transmissions is, in these cases, is not very high.

It is therefore important to keep your clients as thin as possible: 'thin clients'. Perhaps you could also use different dynamically self-adapting clients, and also thoroughly analyze where data and logic could best be positioned.

We should, in this approach, also take into account the impatient 'naive user', who sits nervously clicking with the mouse while he waits - clicking excessively, so to speak. We must find and apply new methods that would also satisfy his or her requirements.

'Thin is in' is the challenge of the coming decade. Thin is shaped by thin clients, thin phones, thin Smartcards, in short: thin everything! When building anything in this context, we should first ask the questions mentioned above. Oh, and one more thing, it's probably clear that 'thin' is not just applied to computers with a monitor and keyboard. In fact, I would be inclined to say: precisely not.

Network trend

It's pretty terrific when we think about businesses and organizations in this new network world. Sun Microsystems uses the slogan: 'The Network is the Computer'. I would like to go one step further and state: 'The Company is The Network'. No more rigid, inflexible borders between departments. Indeed, the company is a collection of processes that we want to allow to work together. As an example, just

think of the modern 'call systems', in which processes and data concerning sales, marketing, order administration, book-keeping, production and logistics suddenly become visible and are integrated together.

The network forms the place where businesses meet each other. After all, what concerns a company within, mutually concerns all companies.

For that matter, one could also suppose in this context that it looks like a long-awaited wish has been fulfilled. Increasingly more competencies are being integrated and fused together. We're talking here about the fusion of computer, entertainment, consumers, and content-appliances (user objects for everyone).

As an IT industry we have been calling for years for this kind of fusion to take place, but we must acknowledge that this is certainly not the case on a large scale. Up until now you got what you were given. We, the IT industry, indicated how other competencies and segments should handle new technology.

In my opinion, the world today has changed in the sense that we as computer engineers are asked - no, charged - to allow this fusion to take place according to the rules that the segments themselves lay down.

How? Java as catalyst

Whichever way we look at it, one thing is clear: we need new techniques to allow this new, changing world, this re-calibration of society to take place.

Software companies driven by protection - especially where the production of program code is concerned - will not survive in this new world. Intellectual property, that's the key. Clever ideas carried within new approaches. Completely new solutions to problems. And especially: completely new products and services. The invention of such new products, and determining strategies and tactics for that purpose, that's what's important. To have a mechanism that builds upon the basic foundations without having to again begin anew each time.

It is clear that the four fundamental questions that computer experts must wrestle with are being answered more effectively and that these answers must be applied ever more broadly. Besides, it is not very efficient to have to keep reinventing the wheel. The four fundamental questions I'm referring to are:

1. Linguistic: How do you communicate with a computer (the user interface)?
2. Algorithms: What is the best method to solve a problem quickly?
3. Architecture: How do we build the best computer?
4. The 'sculpting' of machine-intelligence. Can you write computer programs that can find their own solutions?

How broadly and quickly the answers to these questions can be applied to computers, in whatever form they may be, the faster and better will be the contribution toward re-calibrating our society.

That's why a software platform with an 'open' character is necessary; one which can, via its software orientation, operate the hardware. A platform where, on the one hand (in the traditional sense), programs operate the electronics but, on the other hand (and this is new), on the basis of this produce open, general structure specific hardware driven by software, while at the same time being able to continue to work with all existing hardware.

These conflicting and well-nigh impossible demands can be satisfied by the Java software platform. It is outside the scope and intention of this book to provide a detailed account of Java but, in summary, by using Java we can achieve the following result:

With the help of Java we are able to make applications that can be used on any computer regardless of its brand or type. We call this the 'Write Once, Run Anywhere' principle.

How can we illustrate that? Well, in the first instance, a computer consists of electronics, and programs that operate the electronics - the Operating System. To be able to read data from a hard disk, the electronics must precisely know where the data is stored, and above all they must receive the

exact commands, via an ingenious combination of electronics and mechanics, in order to retrieve the data in such a way that within the computer system something meaningful can be accomplished.

At present, the computer industry is characterized by differences in electronics and operating systems. Almost every manufacturer of computer systems produces a unique combination of both components. The result of this is that application programs - such as a word processing program, a book-keeping program or an invoicing program - is often only suitable to be used on one specific computer. If you wanted to use these same programs on another system then, in general, the programs would have to be adapted.

By applying the principle of 'Write Once, Run Anywhere' such adaptations become unnecessary. An application program is written just once and will then work on any combination of electronics and operating systems without adaptations having to be made.

Technically speaking this is made possible by the establishment of a so-called Java Virtual Machine (JVM) specification, a kind of virtual computer. The Java program code expects that such a JVM is present and in this way can carry out its tasks. Since there are literally hundreds of JVM's, one can rest assured that the principle of 'Write Once, Run Anywhere' has been very successfully introduced, and that Java can be used on every current computer.

Of essential importance is the exchangeability of the code. In other words, there are no specific adaptations. As Java specialists say: the code must be 100% pure Java!

Further, it also well to consider that Java can not only be found on the 'desktop' but also on servers, in Smartcards, and in embedded chips. There are even Java chips ('Chips born to speak Java'). It is precisely this that forms the power of modern IT tools: Java.

100% Java provides us with the possibility to co-ordinate all kinds of systems with each other. We could, for example, lay out the following scenario:

Imagine that you are sitting watching your favorite cookery program one afternoon. The chef on that program is busy preparing a splendid looking chicken dish. It looks so mouth-watering good that you decide that you would like to make it yourself. Now, it just so happens you're having some guests over for dinner that evening, and that dish would be perfect as the main course.

You grab your TV remote and activate a small window on the TV screen. By pressing a few keys you indicate that you want to make the chicken dish and that you will be cooking for four people. The TV thanks you electronically (via a pre-recorded message from the chef of the show) and a recipe message (a kind of e-mail) is sent to the combi-microwave oven and to the refrigerator in the kitchen.

The microwave notices that some ingredients in the recipe can be bought at a discount and passes that information on to the refrigerator. The refrigerator examines, by means of scanning, whether it has all the necessary ingredients. That doesn't appear to be case here, so the refrigerator sends a message to the local supermarket to order the ingredients that are lacking. At the same time, the refrigerator remembers that some of the ingredients can be bought at a special bonus price. The message to the supermarket also states that the items are needed right away.

While you're still relaxing at home on your sofa and before the cookery program that you are watching has come to an end, the doorbell rings. An employee from the local supermarket is standing on your doorstep with your order, which has for that matter already been electronically paid.

Network economy

Well, we realize that a new world is dawning and we also realize that society is re-calibrating. While contemplating the consequences of all this, we the 'computer specialists' are trying to figure out our new role in this game.

Many well-known and lesser-known authors are looking at the processes that are changing and are trying to explain the role that technology is going to play therein. One of these authors is Kevin Kelly⁷, editor of the magazine *Wired* and the www-site of the same name. Kelly originally trained as a biologist, and in his book *Out of Control* he tries to explain, with the help of analogies from the field of biology, the changes that are occurring within and with the help of technology. This is not such a new

approach, however, when we consider that in 1824 Jan Rudolph Thorbecke⁸ (1798-1872) took a similar path in his first publication *Ueber das Wesen und den organischen Charakter der Geschichte*.

Kevin Kelly wrote an article for *Wired* magazine (which he is at this moment reworking to publish as a book), which in the framework of the network economy makes some very interesting points. In this publication he describes twelve principles to which the network economy corresponds to or, as the case may be, differs from the industrial economy known to us. Two examples of these principles are so stunning in their approach and differ so greatly from the present way of doing business, that I have included them here in summary:

Firstly: unique has no value

In our present industrial economic system, unique things have a lot of value. For example, gold is scarce, that's why you have to pay so much for it. This proposition does not arise in a network economy. Indeed, in the network economy, one single fax machine has absolutely no value. Only when the second fax machine rolls off the assembly line does the first one receive any 'value'. After all, you can now communicate between the two devices. If I buy a fax machine today, then I add value as it were to the network. After all, now I'm also accessible to everyone via my fax machine.

Secondly: give away your crown jewels for free

In a network economy, a mechanism is in operation whereby one tries to attract everyone to themselves, but not just through clever advertising campaigns. Kelly suggests that a company needs to give away its crown jewels for free. You make a terrific product, a product which incorporates the best knowledge, skills, experience, and expertise of your company. You then 'place it on the net' and let everyone use it. Once as many people as possible are using that product, you bring out extra functions and extensions, which have to be paid for. Then the 'old' marketing maxim of Philip Kotler⁹ again plays a role: serial and sequential.

It is outside the scope of this book to discuss Kelly's remaining ten principles. My intention here was just to awaken your interest and to show you how refreshing new approaches can be.

Mode-rn Business Management and eCommerce

This section examines modern business management. I've labeled this section 'mode-rn business management' because we need to ask ourselves whether we must follow a 'mode' or trend, or whether we really can create new areas and opportunities by applying new technology meaningfully.

In my opinion, eCommerce, as many call this modern form of business management, calls for a different approach than that what we have been used to up to now. A new kind of manager is needed, someone who is completely comfortable with the concept of change.

eCommerce is not about making more money but is about reducing costs. Just think for a moment about the following examples:

These days we think it's quite normal to draw money from a cash-dispenser or a 'hole in a wall'. My reasoning here is that when we draw money in this way, we are actually 'working' for the bank. After all, previously you had to enter a bank and be served by a bank teller, and then only during office hours (which also often differed than those held by other lines of business). Well, today the bank teller is no longer needed and you can go to such a cash-dispenser any time you want. Thus, costs have been reduced!

Another example is when you go to the gas station. While putting gas in your car you are momentarily in the service of the oil company. Here also human resources are being saved.

An eCommerce example that is used by many people is www.amazon.com. You know, the web-site where you can order books, from a choice of around 130,000 titles, and where they hold on to and extend your 'profile', or in other words, continuously learn more about the wishes and interests of the individual client. That's quite an 'open door' approach. Of particular importance to us here is to consider the following:

Amazon has no stocks!

Look, that's another important point. We all know that capital tied up in inventory does not provide any returns, and have therefore developed intricate and rather expensive stock control systems. Amazon,

however, does not need that kind of system because it works directly with publishers. Besides this, it's reasonably 'easy' for even very small publishers to bring their books on the market in the same way.

Amazon has no debtors!

Did I hear that right - no debtors and still make money? Yes, indeed! By using credit card companies, one has no debtors. Via the credit card company they hear that your money has been transferred and only then is the desired book ordered by them from the publisher. In this way they do not even have to set up and maintain a comprehensive accounts receivable system.

Amazon has no distribution channels

No distribution channel and none of the problems and costs that accompany it. By cleverly using the services of Federal Express, they can guarantee that books will be delivered throughout the world at very acceptable mailing cost levels (paid by the customer beforehand via the credit card company).

See, that's what I mean with the 'reduced cost approach'. The economic and technical possibilities and solutions, that's what it's all about. Those who can manage these mechanisms well and creatively, will be guaranteed commercial success in the new eCommerce world.

The Marketing Approach of eCommerce

The marketing approach around eCommerce is also quite unique, but at the same time still very 'traditional'. We lose ourselves in considerations concerning Content, Retail, and Business Trade.

In the case of Content, the point of departure is the idea that every consumer will, within the foreseeable future, be able to put together his or her own TV program by choosing from a vast array of leisure time programs, in digital format, placed at their disposal.

With Retail the assumption is that within a short period of time every consumer will be buying many goods via the Internet.

Still, it is well to consider that here also you will probably get what you're given. Indeed, so much infrastructure first has to be made available in order to attract consumers to use this phenomenon - whether it's in financial terms or whether it means tools that are easy to use - that in the short term it could all turn out quite disappointing.

Often we don't get further than mentioning Retail as an example of 'the new way of doing business' via the Internet. But after some extra research we make the shocking discovery that the Retail market segment, even in the year 2002, in terms of dollar-turnover, will still not be very big (Forrester Research).

The same is true for Content (think back to those thin clients). The real growth is in the business-to-business segment, but people are generally less interested in this because they immediately assume that it's just a direct replacement of EDI, while the fact is that here also we're talking about the replacement of an rigid, inflexible system with a modern, flexible and more dynamic system - a system in which new opportunities in applications are being created. The transaction size in dollar terms alone is greater, thus it's clear that the total size will stand head and shoulders above the rest by 2002.

The greatest opportunities, in my opinion, actually lie in the discontinuity factors of the Retail and Content market segments: What new products and services are possible which would be meaningful, affordable (for everyone and not just for the highly educated), and easy to use (for everyone, thus also for the 'naive user')? What combinations could be made with technology, and would we then still be talking in terms of Retail and Content? And wouldn't other segments be created in the process?

Example: Connecting up a trip computer (what would actually be just a PDA kind of device) to a weather radar, GPS and traffic congestion system. The resulting device could be broadly applied and quite usable for everyone. But what are we talking about here? Is it Retail, is it Content? Or is it something completely different?

Reliable and available

In any case one thing is certain: everything will depend on reliable and available technology. This is the foundation that needs to be present for responsibly entering our new world.

The argument is not: the one operating system is too 'old' while the other is too 'young'. That sounds more like the 'holy war' kind of argument carried on by visionless, traditional-minded technical specialists who are afraid of losing their status. I realize that this is harsh judgment, but after thirty years in the IT industry I think I'm qualified to state this opinion.

We see around us that still more depends on technology. There are so many new and unpredictable factors. That's why each person must be allowed to apply their knowledge, skill and experience in the most sensible way possible.

Of course, the above example will have the observant reader, who is somewhat familiar with computers, thinking of the differences between UNIX and Windows NT. What is the point then of saying that NT works well even on a 10,000 desktop system but that it's difficult to manage. UNIX, however, can manage - but that's old, isn't it? Oh yes, and then there are so many standards. No, then you should choose the 10,000 unmanageable systems, which will, in any case, again form a good basis for years of war between IT specialists and keep us from the true innovation: the changing world!

Strategic IT solutions

We IT experts, are increasingly becoming aware that good, sensible and future-directed IT strategies do not consist of extremes. To not immediately change from mainframes to minis, from nothing more central and everything on the desktop, from fat servers to fat clients or vice versa. 'Evolution' can also mean 'revolution'.

Opening up new horizons and moving existing borders using our knowledge, skill and experience - that's our job.

Often a choice is made that partly maintains the solution of the past while adding modern ideas and approaches. Just think for a moment of a 'three tier' or 'four tier' approach, in which the existing systems and databases are preserved, but through means of modern, future-oriented server hardware a kind of shell is built, that takes care of connections with the Internet/intranet (web server) or with modern applications (application server).

This approach, of course, is not so illogical. Only, in the past our hardware and software systems were not capable of realizing such things in a reasonably intelligent manner. But now through the use of powerful, scalable, and reliable server technology, through the application of modern software conceptions in deskware methods, and through focusing on the needs of the 'naive user', all these forces spur us on towards new creativity within the IT industry.

What could go wrong now? Pitfalls and excuses

How provocative the world would look if there were no more excuses. In the process of writing this book, I have reflected on and reviewed the last thirty years of the computer industry (that part of which I myself have been engaged in) and I have discovered that our industry clings to excuses and 'holy wars', and it is precisely that attitude that thwarts a faster rate of progress.

Take for example 'Java'. An excellent approach, no self-respecting IT expert can deny that. But it won't do to say that similar initiatives have already been tried earlier. Probably the time was not ripe for them then. It also won't do to suggest that their performance couldn't have been very good. In the first place, you would have had to write the programs quite differently (for example, network oriented instead of desktop, mini, or mainframe oriented), secondly, performance depends on such factors as using an interpreter or compiler, or using new compiler insights such as hotspot compilers. So what's the problem? There's choice enough. Performance of these kind of tools just gets better. It's just a question of time.

But the performance of a new phenomenon like Java does not only have to do with translation tools. Performance here also means the 'footprint', the size that is necessary to store the programs (application programs, servlets, applets, cardlets). Indeed, Java is also used in embedded systems where every fraction of space must be utilized efficiently.

Performance is also: keeping the 'naive user' in mind - those people who don't know what 'loops' are, what 'system hangs' and 'resets' mean and who have no idea what 'back ups' and 'bombs' do. Oh

yes, and then there is also the interface, the connection, and just making things easier to use for everyone.

All these issues surrounding performance are being tackled by the modern Java. But that's not as simple as it sounds. It means hard work. It means no routine, and back to the drawing board. It means: motivation and enthusiasm; the will to innovate. It means the urge to change the world. It means to feel innovation in your bones. And there's no place for excuses.

'Thinking out of the Box'

At last, the time has come. Again, we may and can, think 'Out of the Box'! We can again be creative without having to be ashamed. We have the technological potential for it, without the technological limitations.

What is remarkable about the present is that we not only still have the old style 'innovators' and 'visionaries', but that a much greater number could also qualify itself as such. Today, many of us want to take on challenges and not just work via pre-determined methods or established standards. Fortunately, it appears that many of us have read one or more of Geoffrey Moores¹⁰ books (*Crossing the Chasm* or *Inside the Tornado*), and taken heart. Isn't it a wonderful and motivating time in which we live? Let's use it well!

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Notes

1. **Alvin Toffler** established his name in the seventies with the publication of *Future Shock* and *The Third Wave*. He is often asked to relate his vision with respect to changes in doing business and the new economy. One of his most recent works is: *Creating a New Civilization: The Politics of the Third Wave*.
2. **Peter M. Senge** works at The Massachusetts Institute of Technology (MIT). He is director for The Center for Organizational Learning at MIT and has his own training and consultancy bureau called Innovation Associates. He is well-known for his insights into how organizations learn and share knowledge. He is the author of *The Fifth Discipline*.

3. **Michael Hammer** previously worked at The Massachusetts Institute of Technology (MIT) and presently has his own consultancy bureau. He is rated as being one of the top 25 most influential consultants in the United States . He earned his reputation through his publications on the re-engineering of organizations.
4. **C.K. Prahalad** is Professor of Business Administration and Professor of Corporate Strategy and International Business at the University of Michigan's Graduate School of Business Administration. He is the author of *Competing for the Future*, which is an account of his insights into what it means to be strategic, by seeing through present views with respect to a changing business world, in order to define a more visionary concept of industrial changes.
5. **Warren Bennis** is Professor of Business Administration at the University of Southern California. For more than 40 years he has been advising the top Fortune-500 companies in the area of leadership. He has been advisor to a number of presidents (Kennedy, Johnson, Carter and Reagan). He is the author of the classic work, *Leaders: The Strategies for Taking Charge*. His most recent work is, *Organizing Genius: The Secrets of Creative Collaboration*.
6. **Don Peppers** is founder and president of Marketing 1:1 Inc. in Stamford, Connecticut. He has many years of professional experience in advertising and marketing. His works include, *Life's a Pitch* and *The One-to-One Future*. His most recent publication is, *Enterprise One-to-One*.
7. **Kevin Kelly** is executive editor of *Wired* magazine, and member of 'The Global Business Network'. Kelly is a pioneer with respect to his insights in the placement of new technology in our existing culture. He has very innovative ideas in the area of the network economy. One of his best known publications is *Out of Control: The New Biology of Machines*.
8. **Jan Rudolph Thorbecke** (1798-1872). A Dutch statesman and foremost figure of Dutch liberalism of the 19th century. His most important publication is the five volume work, *Historische schetsen en Parlementaire redevoeringen*.
9. **Philip Kotler** is a well-known author and consultant in the field of marketing. A former chairman of The College of Marketing of The Institute of Management Sciences (TIMS), he is presently director of The American Marketing Association. He is the author of such well-known works, *Principles of Marketing* and *Marketing Management: Analysis, Planning and Control*.
10. **Geoffrey A. Moore** was a partner at Regis MacKenna Inc. before starting his own consultancy bureau. Moore's better known works include, *Crossing the Chasm* and *Inside the Tornado*. His most recent publication is, *The Gorilla Game*.

(text for back flap)

Thinking out of the Box

A Vision of the Future with respect to Organization & Technology

Hans Appel has been working in the computer industry for some 30 years. After studying electronics, he began building and programming hybrid analog/digital computer systems in the late sixties.

In the early seventies he took up employment with Sperry UNIVAC, a company that was engaged in designing, building, and selling mainframe computer systems. After working in different functional areas in systems programming, he took his first steps in the world of marketing in the late seventies.

With the rise of computerization in the early eighties, Appel went to work at WANG, a company that was, in those days, very innovative in the area of computer technology for the office environment. At WANG he performed a number of different functions within the marketing discipline.

In the late eighties he crossed over to Apple Computer, a company that wanted to change the world. Apple had the very unique vision of computer technology being used by everyone. For many years Apple was a model for continuous and ground-breaking innovation. Here also marketing was Appel's philosophy.

For the last two years Appel has been working at Sun Microsystems in The Netherlands. Sun is one of the few IT-organizations where the design of a product still occurs within the same company, from silicon to end-product. It is a company in which the person-technology interface occupies an important place, right next to bringing highly professional IT-technology on the market.

Appel always says: "I have two professions: technology and marketing. The combination of the two fields forms a tremendous challenge. 'Keeping up' with these two dynamic areas is an enormous motivator to excel." We hope that this book will be testament to that.