

# The Role of Telecommunications Technology in the Year 2000

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Products such as the facsimile machine, the video recorder, and the personal stereo are the fruit of numerous incremental developments in technology. Our ability to forecast the „what and when“ of such incremental technical innovations is satisfactory, although the prediction horizon stretches barely seven years. We are not so good, however, at predicting the what, let alone the when, of technical quantum leaps requiring scientific breakthroughs. Examples from the past are the transistor and the laser; future possibilities might be bio-implant communications devices or robotic pets.

Even without new scientific breakthroughs, however, the year 2000 will present individuals and organizations with a cornucopia of telecommunications technologies. These technologies will have the power to improve the efficiency and effectiveness of our business enterprises, as well as to create totally new businesses. The challenge will be to harness and exploit them for the benefit of enterprises and their employees, customers, and other stakeholders.

In the last decade, most managers used telecommunications to improve internal operations. In the next decade, strategic thinkers will reach outside the organization, using technology to link the firm's systems to those of its customers and suppliers. We should remember that it was some time into the first Industrial Revolution before people realized that machines could do more than just replace people: they enabled companies to rethink how they did business and even to create entirely new businesses.

Not only will today's products become more highly featured and easier to use, but they will also communicate and integrate with other products that currently stand alone. For example, pocket communicator diaries will be linked to office diaries to arrange meetings. Without the necessary privacy filters and access control, however, they will also become very full. Unfortunately some of the challenges in the year 2000 will not be very different from today's, and may even be exacerbated by technology. Where today we are deluged by junk mail, tomorrow we may be equally harassed by junk meetings.

The point is that we will need to develop products usable by human beings – products that permit users to enjoy the benefits of the new technologies by retaining control over them. People want the capability to receive calls from anyone, anytime, anyplace, only if they can decide which calls to accept.

Service will be a significant component of telecommunications product offerings in the year 2000. For products such as pocket phones, service will be an integral feature of the offering. It follows, therefore, that product differentiation will be possible based on the quality of service relating to product delivery, operation, repair, enhancement, and evolution. This will tend to encourage „one-stop shopping.“

Four enabling telecommunications technologies that are emerging now will reshape existing telecommunications products and services across a wide range of industries by the year 2000:

- Commodity bandwidth
- Wirelessness
- Intelligent network management
- People-oriented product design

## **Commodity Bandwidth**

By the year 2000, corporate telecommunications users will have unprecedented ability to match their communications networks to their actual needs, essentially unconstrained by the network operators and independent of distance. With bandwidth on demand and virtual reality, a firm can service its New York customers just as well from Omaha as from midtown Manhattan. In the process, network operators will become merely suppliers of commodity bandwidth, unless they learn how to exploit the power of the intelligent network for the benefit of its users (as discussed below).

The availability of 64Kbit/sec pipes now, means that users need no longer be constrained by the telecommunications conventions previously imposed by the operators and their networks. For example, until now, operators have used speech compression to minimize transmission bandwidth while maintaining „toll-quality“ speech (3 KHz audio bandwidth). Over a 64Kbit/sec channel, similar techniques can already deliver „hi-fi“ speech (7 KHz audio bandwidth). In the year 2000, a user community, such as product manufacturers or broadcasters, will be able to access this bandwidth on demand in millions-of-bits-per-second chunks over the public switched telephone network, as well as over leased lines, in order to deliver news, advertisements, and features. Each user or group will be able to use and pay for only as much bandwidth as is required to serve the purpose at hand.

The availability of commodity bandwidth will reduce development lead times by enabling product manufacturers to make virtual reality product demonstrations to neighborhood user panels. The same manufacturers will obtain the technology they need to build their products from global technology brokers, who will use the networks to hawk their wares. In addition, the ability of customers to interact more intimately with their chosen suppliers will create greater brand loyalty.

### **Wirelessness**

Wireless products sell. In the past ten years, a large number of products that previously used cables have been freed of their umbilical cords and successfully launched in wireless form. Examples include laptop computers, pocket phones, and power drills. It is inevitable that many other commercial and domestic products will undergo the same treatment.

By the year 2000, many office telephones will be linked to their PBXs by radio or other wireless means, as will office information terminals to their file servers. The drivers here are convenience, flexibility, and reduced costs for installation and reconfiguration, as well as elimination of the cost of house wiring. However, existing connection protocols, such as Ethernet and token ring, are not appropriate for wireless data links, and the proliferation of proprietary and incompatible protocols is slowing introduction. The IEEE has formed a working group whose task is to release a protocol standard for wireless LANs by the end of 1993. Protocols will be developed that enforce zoning and preclude the problem of the telephone driving the printer directly without passing through the speech-to-text translator. As information becomes increasingly networkable by dispersed user communities, it will be necessary to protect confidentiality and guard against intrusions. Much attention will need to be given to the development of systems that protect wireless data and allow only authorized access.

Wirelessness will spawn many new businesses by adding a communications link to devices that were previously standalone. It will be easy, for example, to link vending machines to service centers able to respond to the need for repair and replenishment. The ability of these machines to summon assistance will offset existing service and maintenance arrangements.

This quality of service will encourage choice and diversity of delivery. Imagine being able to request a print-out of selected news topics at the metro station while buying a chocolate bar – and using your credit card to pay for both commodities.

The prevalence of wireless communication within offices will lead to more flexible working practices. Manufacturers of office partitioning and furniture should take note, as the ability of workers to work wherever the task demands will influence the future shape and configuration of offices. The ability of equipment such as printers and coffee machines to be easily repositioned will further reduce the permanence of office topography.

The ability of intelligent wireless devices to travel with the user and collect his or her working preferences will be of much use to product designers, who will have at their disposal, with permission of the users, a database of user preferences relating to the current-generation product. This information will shorten and improve the product design process.

Wireless bandwidth is a limited resource that must be shared with users outside the mobile, commercial, and residential communication communities. It will be necessary therefore, to conserve and manage the available spectrum effectively. This involves both technical and political questions. There will be continuing pressure to reduce the radio frequency power and size of cellular structures and to introduce more spectrum-efficient modulation schemes. Nevertheless, the more intransigent obstacles to providing adequate bandwidth are likely to be political rather than technical.

### **Intelligent Network Management**

Global telecommunications operators in the year 2000 will seek to increase their added value by embedding decision-making and management facilities in the network. Their objective will be to maximize the intelligence provided by the network, at the expense of customer premises equipment. A simple example is the fax market, where dedicated fax networks enhance the utility of unintelligent fax machines by providing features such as store-and-forward and broadcast.

In providing these features, the networks compete directly with the equipment suppliers, who would like to sell more sophisticated fax machines. As the potential of bandwidth to add value to products and services exerts its expected effects on the prices and margins associated with the sale of bandwidth alone, the telecommunications network operators can be expected to increase their exertions to derive additional, non-bandwidth-related revenues from the capabilities of intelligent networks.

From the user's point of view, the intelligent network will provide seamless integration and control over many separate public and private networks, both wired and wireless. It will contain a range of user agents with which the subscriber will be able to conduct a dialogue, and which will subsequently act on the subscriber's behalf.

Users will ask them to modify the network's behavior to suit individual needs, making use of the network more effective. Already simple features that business customers exploit in their PBXs, such as call diversion and call waiting, are being made available by network operators to residential subscribers. These services are branded Custom Calling in the United States, Star Services in the United Kingdom, and Services Confort in France. Not too many years from now, when we are away from home over the weekend, we will be able to ask the network to cancel the regular deliveries and keep an eye on the house, and perhaps to turn on the heat and the oven so that we will come home to a warm house and a hot meal.

Intelligent network management will support the birth of the truly portable office, as the network will be able to provide the bandwidth and the services that an individual requires wherever he or she is and not simply at prearranged, fixed locations. In addition, embedded user agents in both customer premises equipment and the network will let the user give the system a limited degree of discretion for such mundane business tasks as finding a low-cost supplier or locating the telephone numbers of businesses providing a required service in a given country.

We must not expect, however, that the availability of commodity bandwidth will lead to a complete replacement of existing media, such as books or radio programming. Rather, while it makes possible new products and services, existing products will still be required, but will play different roles, just as radio and TV coexist but serve different markets. Indeed, in the year 2000, the fastest way of getting a 100GByte archive from door to door may still be a box of magnetic tapes delivered by a motorcycle courier.

### **People-Oriented Product Design**

The determination and delivery of telecommunications services will be increasingly machine-assisted. Customers will not tolerate the overhead of learning special protocols (for example, mail system commands) for an ever-increasing number of services of higher complexity. Simple demonstration systems have been built that can „understand“ unstructured dialog, adapt to the user, and cope with mixed-initiative interactions. By the year 2000, these systems will be indistinguishable from human operators in certain applications.

Advances in the technology of hand-held electronic products make it easier to offer very powerful features in compact packages. Soon there will be no physical reason why one hand-held device should not incorporate all the features of a telephone, a pager, an electronic organizer, a calculator, a fax terminal, and a Nintendo games machine. Cost/benefit analyses should accompany development of these sophisticated products, however, as there must be good reason why the average executive desk phone has changed little over the past 50 years!

The time will approach (some would say it is already here) when the number of features per cubic inch will cease to be a factor in product success. Much more significant will be the ease with which these features can be accessed. Watches incorporating calculators and organizers are already available, but at present only the most dedicated technophiles use them because they are just too awkward for most of us. There is a limit to how close together buttons can be packed. Since our fingers will not be getting smaller, radical alternative approaches will be needed. By understanding the relationship between the user and the task, we should be able to tease out user needs which are often very different from expressed user „wants.“ Understanding how users interact with products and learning how to design improved modes of interaction will become crucial, if the full benefits of new technologies are to be made accessible to all.

People-oriented product engineering will ease the burden of interfacing with the network by smoothing the discontinuity between technologies and human beings and allowing us to add our special preferences regarding the style and shape of interaction. Furthermore, interfaces will be adaptable to accommodate us as our needs change.

Our personal communicators will have embedded tools to facilitate organization, document preparation, and planning. They will also communicate through the network with our office information systems in order to help us be more effective. Our ability to handle this level of machine support will depend on the power and simplicity of the user interface.

### **A Question of Outlook**

The degree to which telecommunications technology will shape our lives in the year 2000 will be largely determined by our outlook. Optimists see technology relieving drudgery, making work more interesting, and providing improved control over where and how we work. Pessimists predict that we will be overwhelmed with junk communication and instead of TV channel-hopping, we will spend our time answering the call of various communications devices. In truth, however, technology is only a tool. Its power to help or hinder lies in our hands. In the year 2000, the high performance business will be successful because it will have understood how to harness technology effectively in support of business goals. Defining the latter sensibly and clearly is, of course, no mean task.

In order to be in a position to exploit global markets, the wealth of technology options, and changing work patterns, the successful year-2000 enterprise will have to strike a balance between flexibility and diversity on the one hand, and the strengths of a unified corporate culture and shared business goals on the other. There will be clear advantages for those wishing to exploit year-2000 telecommunications technology (Exhibit 1).

## Exhibit 1

### Three Perspectives on the New Communications Technology

#### *Employee viewpoint*

- It makes working away from the office possible
- It improves interaction with co-workers
- It enhances individual discretion within a goal-directed framework

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#### *Enterprise viewpoint*

- It supports reduced investment in bricks and mortar
- It supports a more diffuse organization but with a tighter culture
- We will need to define our business goals more clearly to exploit it fully

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#### *Customer viewpoint*

- The ability to interact closely with a particular enterprise will create greater brand loyalty
- The complexity of service offerings will point users to „one-stop shops“
- Users' motto will be „give me what I need because I cannot tell you what I want“

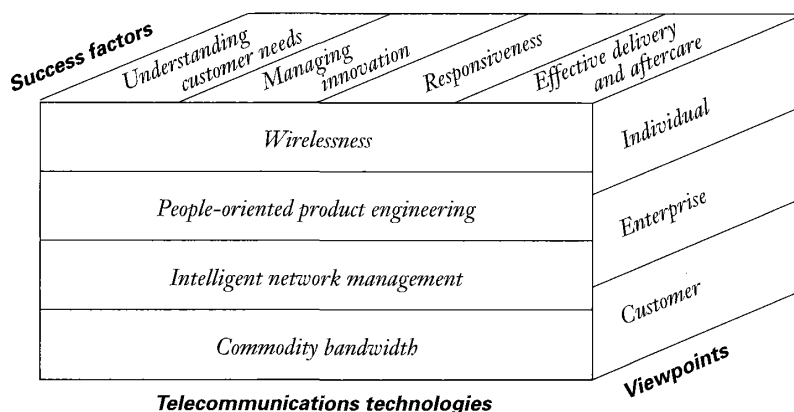
Benefits will include linking enterprises and clients by „high-touch“ communication channels (to build relationships and brand loyalty), enhancing flexibility of individual work patterns, and breaking down departmental barriers.

On the other hand, the introduction of technology by itself will not make things happen (witness the inability of the Telepoint market to develop in the United Kingdom). Ten years ago there was much talk of the paperless office. The fact that offices today wallow in at least as much paper as then, is related as much to people's unwillingness to adapt to new modes of behavior unless they see clear benefits, as it is to the inability of technology to provide a solution.

The business enterprise is essentially a structure incorporating people and artifacts. Since these elements interact with each other, we must strive to understand systemic, organic relationships as well as technical specifications. Exhibit 2 provides an „enterprise box“ framework that arrays the factors addressed in this article.

## Exhibit 2

### The Interrelationships Among Telecommunications Technologies, Success Factors, and Viewpoints



Telecommunications technology in the year 2000 will be powerful but also very expensive if misused. Furthermore, when it fails, it can demotivate staff, paralyze the organization, and alienate customers, as demonstrated by much-publicized complaints about voice mail systems and the recent outages of telecommunications service in several regions of the United States. Organizations need a greater understanding than they have today of how to mesh technology, organizational relationships, and incentives to meet business objectives.

It will probably be some decades beyond 2000 before we will be able to exploit the full human bandwidth of touch and smell and tap the power of virtual reality in our daily communications-dependent business activities. Nevertheless, as communication through the network with full motion, high-definition color imagery and hi-fi sound becomes economically feasible, most likely by 2000 or shortly thereafter, new opportunities will arise for achieving competitive advantage.

The ability of the year-2000 high-performance enterprise to exploit available telecommunications technology in order to provide competitive advantage will differentiate it from the enterprise that merely uses the technology to improve the efficiency of existing but often inappropriate ways of working.

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