The Intelligent Home of 2010

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This paper provides a view of an intelligent home in the year 2010. It will examine some of the critical technologies that will lead to the home's new appliance—the control processor, and discusses activities that may become commonplace in the home of 2010.

Introduction

By the year 2010, activities within the home will be heavily influenced by a wide variety of interactive information and control systems. A new appliance will be incorporated into the home; a control processor, which will monitor and control many household functions and provide a gateway to communicate with the outside world. This paper will discuss technological developments which will be critical in the evolution to the intelligent home. It will describe the intelligent home and give examples of how these technologies will be employed both within the home and to interact with the external world.

The Critical Path of Technology

Technology does not stand still. Technological progress is a daily happening; new equipment, software and services are constantly being offered to the market place. Laboratories across the country and around the world are researching a wide variety of communications sciences. At any point in time, a large number of these technologies are called upon to deliver a useful product or service. Future progress will also require advances across a broad range of these disciplines.

However the overall progress of any industry is ultimately determined by the rate of advance in one or two "key" technologies. One can accept, as a given, that the needed progress in the supporting technologies will be forthcoming. By correctly identifying the "key" technologies and closely examining their rate of technological advance, one is able to improve the accuracy of his or her predictions of the future.

Figure 1 depicts the "key" technologies for the telecommunications industry. In the 1950s and 60s the dramatic advances in electronics and solid state technology led to the stored-program control era and largely determined the nature and rate of advancements and progress within the telecommunications industry. In the 1980's, we are still dependent on a continuation of electronic progress; but increasingly photonics is the critical technology and is determining the rate at which telecommunications advances into the provisioning of broadband-based services.

As we move toward the year 2010, we will still require the electronics and photonics sciences to continue to double their cost performance capabilities every eighteen months. However, the level and range of services that the telecommunications industry will provide in the year 2010, will be largely determined by two emerging "key" technologies—Informatics and Ergonomics.

Informatics

Informatics is from a French word used to describe information processing. I am using it in the context of defining the ability to produce software in an economic and timely fashion so that the advances in electronics and photonics can be fully exploited. Increasingly, we find that only a fraction of the capabilities provided by the advances in solid state VLSI technology can be fully utilized because of our inability to produce software to fully utilize the capabilities of the hardware. The ability

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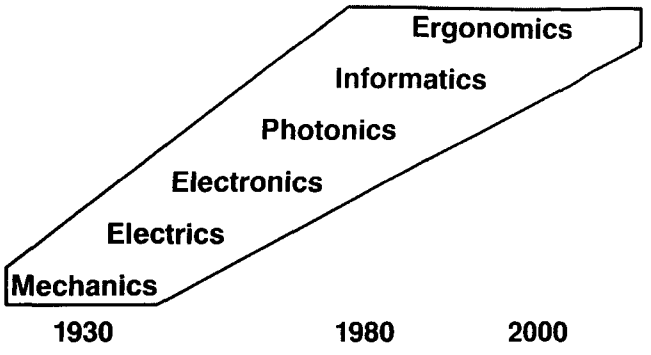

Fig. 1. The Critical Path of Technological Evolution

of the public network to provide the flexible customized services required by the modern day telecommunications user will depend on the rate of progress that can be made in informatics, and the ability of network planners and implementers to transfer these capabilities to the public network through the evolution to the architecture of the intelligent network.

Ergonomics

Ergonomics is the design of man machine interfaces which conform to the biological needs and wants of the end user. Success in informatics alone may permit the offering of information services that the mass market may want and need, but cannot utilize because they are not willing or able to learn a new computer language or spend numerous hours at a terminal learning or relearning a complex inflexible set of interface protocols. What is required are user interfaces which allow humans to communicate with machines and networks using the natural human senses and language. These encompass: speech recognition, machine vision, natural languages and machine intelligence. The phenomenon that we are observing today, whereby a large body of the potential users of a service or capability find it too difficult to either learn in the first place or remember how to use a new service, will become even more acute without major breakthroughs and advances in ergonomics. This is particularly true of the public network which numbers among its strongest assets the ability to offer products to the entire population. Ultimately, the level of service sophistication available to the residential user in the year 2010 will depend largely on the success that has been realized in solving this ergonomics challenge.

The Intelligent Home

In 2010, homes will be equipped with a new appliance: a control processor which will integrate many functions within the home and will be the gateway to communicate and interact with the external environment. The control processor will receive messages from and send messages to various devices in the home. Monitors and controllers will sense and adjust temperature and humidity. Motion detectors will track occupants' movements, turning lights on and off as they enter and exit rooms.

The control processor, via the motion detectors, will know where residents are and will direct incoming phone calls with audio and video into occupied rooms. The intelligent home owner will interact with the control processor verbally. Speakers dispersed throughout the home will "listen" for commands. A speech recognition system either, integrated into the control processor or a value-added network service, would be programmed to interpret users' commands. The user would be able to verbally lock and unlock doors, originate phone calls, and interact with the outside data and communication world. All rooms within the house will have monitoring and controlling devices.

The Kitchen

The kitchen will have a video monitor, quite different from today's monitors. It may hang on the wall like a picture or could be a part of the refrigerator door. Verbal commands will activate programs that will allow the family calendar to be viewed, updated and changed. One could either view recipes or have verbal instructions assist one while moving about the kitchen preparing the recipe. Shopping lists could be verbally prepared and displayed on the screen and stored for future reference. A grocery shop at home service could be called and the shopping list along with other information would be transmitted for processing.

The Living Room

The living room would also house a type of advanced terminal where interactive voice and artificial intelligence systems would help display text, graphics, and high definition TV onto a large screen. Outside entertainment services would be brought into the home, such as: electronic newspapers, video on demand, high-quality audio, high-definition TV, video arcade games, and interactive games with other humans. The outside entertainment world would only be a call or verbal command away.

The Study

A computer terminal or P.C. would be the focal point in the study. Bookshelves might still cover the walls, but the monthly bills would not be piled on the corner of the desk waiting for attention. Family members would review and send mail, including bills, electronically. Outside data bases containing volumes of books, magazines and periodicals for pleasure, business, finance or health would be accessible via the terminal. Residents could work, study, even attend video college from the home utilizing the capabilities of the emerging informatics network.

The Basement

The control processor would take its place with the furnace and hot water heater in the basement. All monitors, relays and switches would be connected, sensed and controlled by the processor. Modems attached to the processor and the processor itself will be responsible for linking the home to the outside data and communication world. Fiber optic technology will be used to transport information to and from the intelligent network and the home. The control processor will house a speech recognition system which would interpret

commands and activate programs to facilitate the desired response. Verbal commands would be transmitted to the service and its voice recognition system would send back instructions for the home control processor to execute.

Home Activities of 2010

Assuming that everything happens as discussed above by the year 2010, here are three scenarios of how the intelligent home could interact with and for the home owner in the year 2010.

The Furnace Repair Person

The home-owner's furnace needs repair or maintenance. The home-owner no longer has to stay home or have a neighbor wait for the repair person. The intelligent home will be programmed to contact the homeowner at work when the repair person comes to the front door.

A scenario may go like this:

A repair person comes to the door and the control processor, activated by a pressure pad under the mat or by a light beam detector, initiates a software program. The control processor, either visually on a small display at the door or verbally via computer-generated speech, will ask the caller to "stand by" while it gets in contact with the home-owner. The control processor will call the home-owner at work. The broadband switching network will transmit video and voice of the repair person to the home-owner's workstation. The repair station will only hear the voice of the home-owner.

The home-owner can access an outside data base that will check the repair person's I.D. using his SS #, name or date of birth. A photo image of the person along with employment information would appear on the workstation next to the video image of the repair person. The home-owner, confident that the repair person is legitimate, instructs the home control processor to open the front door. The control processor will monitor the movement of the repair person and stop him from wandering by asking that he "restrict his movement to the furnace area of the home." The home-owner could set up a temporary camera by the furnace to view or videotape the repair persons activity.

The home-owner has requested the repair person to call them back once the repairs are finished. This is done by closing the front door and standing on the mat or crossing the light beam. The control processor is activated again and asks the repair person to "stand by" and contacts the home-owner at work. The repair person and home-owner discuss the repairs and the associated cost. The repair person asks if the key pad by the door could be used to make an outside call. The home owner sends a message to the home control processor to reconfigure the home, allowing a call to be made from the front door. The repair person keys in the charges to his company's computer where an electronic bill will be created and sent back to the home-owner.

The repair person leaves, the home-owner asks the control processor to secure the home. The control processor locks the front door and reports back to the home-owner that the home is secure. Not expecting any more visitors the owner deactivates this software package.

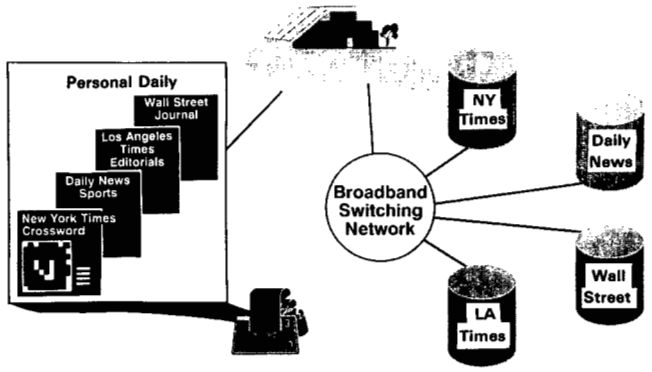

Fig. 2. Personalized Paper

Personalized Newspaper

The home owner used to get two newspaper hand-delivered to his door: The New York Times and The Wall Street Journal. His reading habits involved going first to the *Times'* crossword puzzle, upon completing or almost completing the puzzle, he would then review world news, and then would browse through the *Wall Street Journal* looking for articles concerning his business, telecommunications. Sophisticated information services may allow the home owner to create his own personalized newspaper sequenced in a manner that reflects his own reading references. (See Fig. 2)

A scenario may go like this:

The intelligent home-owner will purchase software that instructs the control processor to dial up newspaper data bases and collect specific sections of certain papers: the crossword puzzle from *The New York Times*, the sports section from the *Daily News* and the editorial section from the *Los Angeles Times*. The home-owner may opt to subscribe to an outside service which would assemble and deliver a personalized newspaper to the residence electronically.

The control processor or outside service would be instructed to search through the *Wall Street Journal* and pull out the articles that deal with telecommunications. The home-owner has set up key words which will help the processor or newspaper service provider to sort out articles which will be of interest to the home-owner.

The home-owner would instruct the control processor to have these sections printed out and waiting for him when he gets home in the evening.

The control processor has also been instructed to collect stock information on specific stocks. This information is stored and not displayed until requested.

The home-owner would also have access to numerous data bases containing a wealth of published information. The home owner, utilizing the control processor or outside service provider, will call upon the intelligent network's signalling and data transport

capabilities to effectively create their own customized information acquisition center while performing a valuable screening effort thus preventing information overload.

Video on Demand

A scenario in the living room in the year 2010:

The family has gathered in the living room to watch TV. Dad, with speech recognition, asks to view the sports programming for that evening. The processor sorts out sports programming from the local electronic paper and displays the evenings sporting events on the large screen. Dad seeing that the ball game is on channel 14, states "CHANNEL 14 PLEASE". The home processor interpreting the command tunes in channel 14 and transmits the signal to the large screen in the living room.

Mom is unhappy!

She retaliates, asking to view movie programming for that evening. The processor already sending the ball game to the large screen, blocks off an area so movie programming can be viewed. Again the electronic newspaper is scanned and the evenings movies are displayed in the blocked off area.

Nothing good on TV tonight.

Johnny asks if he can check the local video on demand service to see if they have gotten the newest movie release: Rocky XXII. The control processor is instructed to display the newest movie releases from the video on demand service "Video View". The processor contacting Video View accesses it's newest release file. The file is displayed in the blocked off area of the screen.

"They have the movie, can we see it Mom?"

Mom asks to view movie #4. Mom's verbal command is interpreted and sent to "Video View," which replies by displaying, "Do you want to view Rocky XXII Yes or No." Confident that Video View has received the instruction correctly, Mom answers, "Yes." The movie is displayed in the blocked off area on the screen. While the movie is being viewed billing information is being transmitted between the control processor and the video-on-demand store.

Mom and Johnny are upset that they have to watch the movie on the small portion of the screen and pressure Dad to turn off the ball game so they can see Rocky on the large screen.

Dad states that he has work to do and asks the control process to re-direct the ball game into the study.

Conclusion

For the above-scenarios to become a reality, technology will have to solve the informatics and ergonomics challenge. Ways will have to be found to develop software that will readily permit taking advantage of the enormous technological advances that are certain to occur in the fields of electronics and photonics. Even more challenging will be the task of solving the ergonomics issues. The intelligent home cannot reach its full potential until humans can make their desires known to machines using their natural human sensory skills for communicating and interacting. Lastly, our government leaders will have to create an environment that does not impose arbitrary limitations on the implementation of this technology.

Casimir S. Skrzypczak was appointed Vice President of NYNEX's Science and Technology department when it was formed on September 1, 1985. He is responsible for the formulation of NYNEX's strategic technology plans and for the direction of NYNEX's research and development programs, including the operation of the NYNEX Science and Technology Center. Prior to joining NYNEX, Mr. Skrzypczak was Vice President of Network Planning at Bell Communications Research Inc.

He has published numerous articles on telecommunications network planning and evolution and is a widely recognized spokesperson on telecommunication architectures and technology trends. He is a member of Tau Beta Pi and IEEE and has served on a number of National Research Council panels. He also serves on the Board of Directors of Teknowledge and Battery Ventures.

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