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Personal Information Service (PIS)—An Application of Wide-Band Communications, 2012 A.D.

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Predictive Paper

With the affluence that comes with economic developments and technological advances, citizens around the world will demand personalized, on-demand, high-quality information services, which I will call personal information service (PIS). I foresee that by 2012 A.D., a variety of communication services, and in particular PIS, will be much more widely available around the world. To make such services available to the masses, a number of challenges have to be overcome. In this paper, I will address the challenges. I believe that by working together, we can obtain solutions by 2012 A.D.

Keywords*—*Broad-band communications, future communication services, on-demand services, personal information service.

I. INTRODUCTION

It was with some apprehension that I accepted the invitation to write a companion predictive paper to "The Full Use of Wideband Communications" by Sir N. Ashbridge. For one thing, prediction is an art, rather than a science, and I have never been known as an artist. For another, technologies are changing at an ever increasing pace, and if Ashbridge's job was difficult 35 years ago, my job would be even more difficult today. Nonetheless, I was intrigued by the possibilities of what would be available in the future in communications, and therefore, in this paper, I will describe my predictions. In particular, I believe a new multimedia information service, which I will call personal information service (PIS), will be widely available by 2012 A.D. I will describe PIS and the challenges to be overcome before it will be widely available.

First, let me summarize Ashbridge's predictions.

A. 1962 Predictions

Considering that Ashbridge wrote his paper more than 35 years ago, and that technologies are evolving at such a pace as to make even five-year predictions difficult, he was pretty accurate. He accurately predicted that computers would play a very important role in communications, that the teleprinter would be replaced, and that high-resolution fax machines would be developed. He suggested that computers would play a supporting role, however, "tying together several systems and selecting the best path or sequence of paths for a particular message." He failed to predict the possibility and the impact of interconnecting millions of computers, as currently exists on the Internet, so that fax machines will probably be obsolete by 2012. Of course, many of us, even five years ago, would not have predicted that the Internet would be as popular and ubiquitous as it is today.

The major difficulty of wide-band communication is to find the resources and bandwidth to send the information. Ashbridge also predicted that "the urge to convey unlimited information over the globe will be sufficient to free the enormous sums of money which are needed to solve the problem." However, his vision of the future communication structure is quite different from what we have today. Ashbridge believed that the globe would be connected by wide-band radio channels, and that the major problem would be local distribution, i.e., how to connect every inhabited building to the network. This is contrary to the present development, in which we expect to have backbone networks that will be primarily fiber based but may also be wireless, primarily satellite based, and local distribution networks will most likely be wireless. Although many people will still be connected to the network from their homes and offices by wires, to support mobile communications, wireless local distribution is unavoidable.

Ashbridge also went on to say that the local distribution problem would be solved by "composite pipes carrying all services." The services to which he referred were utility services such as electric power, gas, and water, in addition to information. His statement would be correct today if

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we consider ”composite services” as voice, video, and data services, such as those provided in integrated services digital networks (ISDN).

Last, Ashbridge predicted that “man will be able to communicate almost any piece of information to anywhere.” With the advent of global satellite networks, this is in fact true today. However, this type of service is available to only a very limited segment of the world’s population. In fact, a large portion of the world’s population does not even have plain old telephone service more than a century after its birth. Those people live in the developing and underdeveloped areas of the globe.

B. A Dynamic Future

I believe, however, that there will be dramatic changes in the next decade. It is generally believed that in that time, the fastest growing economies of the world will in fact be in those developing and underdeveloped countries. Those countries also realize that to sustain their economic developments, a first-rate telecommunication infrastructure is essential, and they are earmarking much investment in this area. In addition, with the affluence that comes with economic developments, the citizens in those countries and around the world will demand personalized, on-demand, high-quality information services.

So, here is my own prediction: I believe that by 2012 A.D., communications, and in particular PIS, will be much more widely available around the world.

The impact of such wide availability of communications in a variety of forms is enormous. The world will become homogeneous as more and more people have access to the same information and become influenced by it. We will have a truly global marketplace in which information, services, and goods will flow readily across national boundaries. There will be developments that are impossible to predict, including the creation of new industries that we cannot begin to try to imagine today.

The following is an outline of the rest of this paper. In Section II, I will describe PIS and its impact on our lives. In Section III, I will identify the challenges that must be overcome for the provision of PIS. I will conclude in Section IV.

II. Personal Information Service

The development and deployment of all new technologies are driven by costs, customer needs, and applications. For example, AT&T Bell Labs demonstrated video telephony in the 1960’s, but it was not popular because the customers did not believe that the services provided justified the additional costs. Video phones are now readily available and not all that expensive, but have poor-to-marginal video quality due to the bandwidth limitations of the existing telephone infrastructure. Therefore, for video phone communication to be truly popular, advances must be made in data compression and transmission technologies to enable the delivery of high-quality video over limited bandwidth. I believe that if there is a need, customers will be willing to pay for it. Technologies will be developed that will drive down the costs and improve picture quality, thereby spawning additional applications and, in turn, additional technologies.

The time is ripe for the development of PIS. Such services are characterized by being personalized—i.e., tailored to the individual user—and ubiquitous—i.e., available anywhere, anytime. For example, in the past, we were satisfied with broadcast television (TV), in which millions of people viewed the same programs, but now we want video on demand (VoD), which allows one to choose the video one wants at the time one wants and to interact with the video. In the past, everyone who subscribed to a newspaper read the same version. The reporters collect news and stories, and the news editors decide what will be printed. Nowadays, many newspapers are on-line, and the readers can have customized newspapers. One person may want to read more about sports news, while another may want more financial news, etc. In other words, the readers are their own news editors. However, news editors should not be worried that they will be unemployed. The development of the Internet and the World Wide Web makes it very easy for anyone with anything to say to put his information out there. Unfortunately, since much of the information is not reviewed or verified for accuracy, there is much junk out there. Pending the development of a “quality search engine,” we do need good news editors to help us sort through this “information pollution.”

Another example of PIS is personal communication service [2]. Each user is assigned a personal telecommunication number and may be reached anywhere in the world. In addition, each user will be able to access a variety of communication services on demand.

A. Impact on Our Lives

When PIS becomes widely available, it will change the way we live dramatically. It will change the way we work. Today, most of us work in centralized corporate facilities. But with telecooperation widely available, more of us will be working in distributed satellite locations, or even in our homes. The need to travel for business will be reduced, while we will probably travel more for leisure. Electronic commerce will be widely practiced. We will shop, bank, and be entertained in cyberspace. With electronic commerce, the way that companies market themselves will be very different also. Now, they rely on printed brochures and advertisements on TV or in magazines, and they can control the image and information they want disseminated to the public. In the future, their first contact with their customers will most likely be through a communication network. The customers will want to have instant access to information and services. Regarding instant access, a big advantage available with PIS is the capability to disseminate information widely and instantly. We will have up-to-the-minute news, and information will be updated continuously and made instantly available to the users. There will be PIS radio and TV stations, just as we have Internet radio today. New forms of entertainment will also be available.

Currently, when we talk about an immersive experience or virtual reality, we are focusing on only two aspects of human sensation, namely, sight and sound. In the future, we can probably simulate and replicate other sensations such as smell and touch. Suppose we are trying to recreate the experience of trekking through a tropical rain forest. I can imagine the development of an immersive capsule. The user enters the capsule, and as he walks around, the user will be able to see the trees, hear the birds and insects, smell the forest, and feel the heat. A pair of gloves will be worn by the user, and as he reaches out to touch something in the forest, the glove will simulate the sensation of various textures. For added effect, we can probably simulate a couple of rainstorms in the capsule, although in this case, the user should be reminded to bring his raincoat.

B. New Paradigms for Education and Professional Services

The way we learn will be different also. There will be virtual classrooms, virtual libraries, and virtual universities. The need for face-to-face instruction, and hence the number of professors, will be reduced. Instead, there will be a few star professors who are extremely good at delivering information, which will be sent to students around the world. These star professors will be very highly paid, just as our entertainers are today. Of course, some forms of teaching will never be replaced by virtual teaching and will require face-to-face instruction. An example is the teaching of research students. They need to observe the way their professors operate and learn by imitating their behavior. But I believe there will be fewer teachers required overall. In fact, there will be fewer doctors, lawyers, and accountants. One obvious tradeoff will be the general loss of "bedside manner" and personal/human interaction. With telemedicine, however, a doctor can serve more patients. He will be able to see a patient, read the patient's medical records, charts, and X-rays, and consult with other specialists, all in cyberspace. Does that mean that many of us will be out of a job? I do not think so. With the increased productivity that comes about because of PIS, all of us will work less and have more leisure time to pursue our hobbies, to travel, and to enjoy life. (Some might say, however, that they have heard this optimistic scenario before.)

Last, and perhaps most important, since everyone will be able to access this PIS network, and most information will be available on the network, there will be very few secrets. The world will become more homogeneous as all countries obtain the same information and are influenced by it. Each individual, however, will determine the particular subjects of the contents that he receives.

C. PIS Infrastructure

Advances in computer, communication, consumer electronics, and information technologies in recent years have actually made some of the personal information services described earlier available today to particular people. To make them available to the masses, however, requires us to overcome a number of challenges. In particular, we must develop the infrastructure and protocols to support such services. This infrastructure will be a network of networks, including the existing public telecommunication networks, satellite networks, wireless networks, the Internet, etc. We have to study each such network not only as an independent entity but also as a collection. In addition, we have to tackle the problems that arise at the interconnections of such entities, since each of them has very different characteristics. For example, Internet phone is a very popular new service. It is popular because the "conversation" is digitized and transmitted as voice packets on the Internet, which is basically free of traditional telecommunications toll charges. Users are accustomed to making telephone calls with a telephone, however, not with a computer with an attached microphone and speaker. Therefore, the proper design of an Internet protocol gateway is important. Not only must this gateway make the Internet transparent to the users but it must also be able to interface between the existing public switched telephone network and the Internet in order to achieve seamless communication. In the next section, we shall address these challenges.

III. CHALLENGES

In this section, we shall identify the characteristics of PIS and study some of the problems that must be overcome before the luxury of PIS can be made available to the masses.

A. Personal Services

The tailoring of services to suit the tastes of individuals invariably requires dedicated (no sharing) resources. For example, most existing implementations of VoD [1] require a dedicated video stream for each individual customer. The number of users who can access the service is limited by the resources available in the system—in this case, the capacity of the video server and the transport network. Compared with broadcast TV, in which one video stream may be shared by millions of people, this is not very efficient. However, this is a price we have to pay for personalized service. The key, therefore, is to provide personal services while at the same time maximize the sharing of resources. We have attempted to solve this problem in the context of VoD. The split and merge protocol [3] allows sharing, yet it appears as if each user has dedicated resources. The customization of services in PIS will also require intensive processing. A customized newspaper or magazine requires much more effort at collecting and disseminating information according to the individual user's preference. Therefore, we need to identify ways to do this very efficiently. Ongoing research in multimedia indexing and retrieval will hopefully shed some light on this problem. Since the information will be available in various languages, a universal translator that automatically translates the retrieved information into a language designated by the user will be required.

B. Ubiquitous Access

In the future, not only do we want personal services but we also want to have them wherever we are. Thus, we want to have such services not only at home and in the office but also on a plane in the middle of the Pacific Ocean. We do not care how this service will be delivered, so long as the quality is there whether we are sitting in our living rooms or sitting in an airborne plane at 30 000 ft. Since the different network entities have very different characteristics, a network protocol developed for one entity may not work well in another. We need to develop new protocols that automatically adapt to the various transport environments so that the users can focus on the applications rather than the underlying network infrastructure. For example, to support mobile multimedia services, we have to study how to provide an integrated solution to such problems as mobility management, multiple access, and real-time delivery.

C. High-Fidelity Access

To ensure that we will be able to obtain the same high-quality services wherever we are, the underlying infrastructure and protocols have to be adaptive to demands, especially since the demands due to different applications may be dramatically different. Thus, we have to study the characteristics of the traffic due to different applications, the relationship between such characteristics, and the quality of service (QoS) perceived by the users when different amounts of resources are allocated, and develop methods to allocate such resources optimally to satisfy the QoS.

IV. Conclusions

PIS supports "any service, anywhere, anytime" as demanded by the user. Advances in computer, communication, consumer electronics, and information technologies in recent years have actually made such services available today to select people. Making them available to the masses, however, requires us to overcome a number of challenges. In this paper, I have addressed some of these challenges. I do not profess to know how to overcome all of them, but at least I hope I have been able to draw a map that will lead us to the solution by 2012 A.D. if we work on it together. What happens to communications later in the next century will depend equally on our own creative ingenuity and the demands of an ever changing world. For an update, check your personal information service in 2012 no matter where you might be.

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