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Internet, TV and Telephony: Are They Finally Converging?

This paper presents some of the forms in which telephony, computer, Internet and television technologies—and markets—'integrate'. It analyses the technologies deployed, the products offered, and the major industry activities in each area: cable telephony, Internet telephony, Internet television, computer telephony integration, and Internet—Telephony—TV integration.

Cable telephony involves the offering of telephone services, and high-speed data, over the hybrid-fibre-coaxial networks that multiple service operators (MSOs) own. Cable operators have embraced the idea by offering cable modem solutions, and major telcos are considering it an opportunity to expand their network footprint.

Placing and receiving telephone calls over the Internet, 'Internet telephony', becomes increasingly popular. Through the various implementations, PC-to-PC, PC-to-telephone, and telephone-to-telephone, IP telephony is expected to take over significant percentages of the communications market.

'Internet television' products offer the benefits of interactive, on-demand, multimedia videos to complement existing television programming on the PC or even TV screen.

Call centres, the main products of computer telephony integration, are part of our everyday life and a significant component of customer services of many businesses.

Finally, products that enable television programming, telephony features, and Internet access over our TV sets promise to make 'web-tone' as popular as dial-tone.

All areas of convergence seem to gain increased industry interest, and market attention. The costs of implementation and the resolution of any technological constraints, along with the industry activities and overall market acceptance, will determine the forms of telephony integration that will prevail.

Introduction

With the recent announcement of USWest's '@ TV' trials later this year, the issue is again in the foreground: are Internet, TV and telephony finally converging?

The answer to this question probably captures the vision of our future communications: a single screen that connects us with the rest of the world so we can talk and see our beloved ones, send our documents to our colleagues, while watching movies and researching the web at the same time.

This paper attempts to present some of the various forms in which computer technologies, Internet global networking, television programming, and telephony advanced services and features intertwine to produce a wide range of products for the present and the future.

Alliances and mergers among the major leaders of the computer, telecommunications and entertainment industries promise to redefine our present notion of 'communications' and guide us into the unimaginable interconnection possibilities of the Millennium.

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At the end of this century, and the beginning of the new one, the blurry boundaries between our PC, conventional telephone sets and TV screens disappear for the sake of 'convergence'. Diverse naming schemes are used to describe the numerous integration forms: *cable telephony*, *computer telephony integration*, *Internet telephony*, and *Internet television* are only few among them.

Any attempt to define accurately these 'convergence' terms and classify strictly the various existing products that fall under them would be worthless. Especially, since most of these terms are often used loosely by the industry, and their definition areas are overlapping.

The following paragraphs will try to cast light on the most recent industry activities in the main areas of convergence, in an attempt to evaluate the current market pulses, and estimate the industry's future plans. More specifically:

- In the 'Cable Telephony' section, the transmission of telephone signals over cable (HFC) networks is described.
- In the 'Internet Television' section, television serves both in its conventional form to receive broadcasted cable entertainment signals and as an access device to the Internet world.
- In the 'Internet Telephony' section, the delivery of telephony over the former data networks, the expansion of Internet protocol (IP) telephony, and the use of PCs to place and deliver telephone calls are discussed.
- In the 'Computer Telephony Integration' section, computer data are entered through the telephone handset, and telephony features are appearing on a computer screen.
- Finally, in the 'Internet, TV and Telephony Convergence' section,

our former TV set may equally be our telephone, the home entertainment theatre and a user-friendly web browser.

Convergence 'happens' either in the telecommunication networks, or at the receiving-end devices. And in all of these convergence forms we watch the 'converging' of the formerly distinct industry segments.

Cable Telephony

Cable telephony enables users to receive telephone service over the cable network, instead of the traditional twisted-pair copper telephone network.

The communication networks owned by cable companies, called *hybrid fibre coaxial* (HFC), are composed of fibre optics that run up to the head-end stations and coaxial for the last mile to the customer premises. HFC networks offer increased bandwidth to the user, and, with slight network alterations, they can provide cable, telephony and high-speed access to the subscribers' homes.

Pure cable HFC network implementations offer 450 MHz up to 750 MHz or more capacity. Upgrades to the network increase the upstream bandwidth, so that the network can operate 'two-way'. In the upstream, 330 MHz–450 MHz is used for the cable, and the 5–42 MHz band is used to carry telephony and data signals, while in the downstream traffic 50–750 MHz channels are allocated for telephony and data. Cable modems at the head-end stations and the customer premises communicate through these channels allocated for data and telephony.

Cable telephony may be either circuit-switched or, more recently, IP cable telephony.

Circuit-switched cable telephony implementation requires the multiple service operators (MSOs) to build another logical network over the same physical cable infrastructure (high-speed data architecture). The disadvantages of such an implementation are clear: operational, economical and technological (spectrum) inefficiencies; cable operators are required to allocate separate upstream and downstream bandwidths to each service, and maintain and operate two technologically distinct operating support systems and platforms.

In IP cable telephony, telephone audio signals are digitised, formatted into packets and transmitted over data networks, received and decoded at the other end in the receiver's telephone handset. MSOs can carry such telephone signal packets over their existing networks without major changes once the networks have been upgraded to support two-way data traffic and the appropriate modems are installed at the subscriber's premises.

Upgrading the cable network to two-ways may be very costly, estimated around $200–$250 per home. Therefore only some of the MSOs have already upgraded their existing network infrastructure†. Others are offering telephony over one-way cable systems: fast downstream transmission through cable modems, and use of traditional telephone modems for the upstream communication over the public switched telephone network (PSTN). MSOs that are following this strategy are trying to gain a small share of the Internet services market before they raise the capital to upgrade their networks.

With cable IP telephony, cable operators will be able to offer multiple services over one platform. The services will include voice, data, enhancements for cable TV services, and value-added features, such as integrated voice mail and e-mail messaging, and real-time provisioning of additional telephone lines without having to rewire a home. Technological challenges to offer toll-quality telephone service seem to be the only obstacle.

The cable market offers opportunities for software vendors, computer components manufacturers, telephone equipment suppliers, cable operators, telephone carriers, and Internet service providers. Mergers, acquisitions and strategic agreements have drastically changed the competitive landscape, which is expected to change even more.

Cable operators, instead of offering cable telephony and data services directly, have responded to the demand for high-speed Internet services by selling cable modems. North America MSOs serve 550 000 cable modem subscribers*, outpacing telephone companies in the race to offer broadband Internet access. Cable modem services have been available to more than 20 million homes, or 20% of all cable homes in North America. More than 85% of these subscribers are receiving service with two-way cable modems and the remaining with telco-return products. As a group, the North American cable operators are currently adding more than 2000 cable modem subscribers per day.

The potential revenues are expected to be enormous. Internet telephony may cause telcos $8 billion loss by 2002, and reduce by 6% the US telephone traffic that the incumbent local exchange carriers (ILECs) are currently handling‡.

Some of the recent activities from the market leaders include:

- *AT&T's* 'flirting' with cable telephony. With the acquisition of TCI, North America's largest cable operator AT&T is planning to deploy HFC networks to enter the local telephony markets. The acquisition of TCI has not been AT&T's only move into the cable market. AT&T has been trying to sign up other MSOs for cable telephony joint ventures to increase its US broadband service footprint.
- *@Home's* high-speed Internet service offerings provide an alternative to PC-based Internet access platforms. @Home connects its subscribers to its broadband IP backbone network with cable modems. The company is also offering comprehensive networking and systems integration services to MSOs that are entering the Internet business.
- *Road Runner*, Time Warner's high-speed data venture with Media One, Microsoft, and Compaq, already claims more than 180 000 cable modem subscribers.

Internet Television

Internet TV is perceived as a single product that combines Internet access and television programming. In reality, this product may have technologically two forms: intercast technology, and streaming video.

† In the US market: Time Warner, Media One, Comcast, Cox Communications and Rogers Cable Systems are among the ones that have upgraded their HFC networks to two-ways.

* Kinetic Strategies estimates, BYRNES, CHERYL. Cable Telephony Market Trends, Faulkner Information Services, April 1999.

‡ BYRNES, CHERYL. Cable Telephony Market Trends, Faulkner Information Services, April 1999.

Intercast technology is the result of the combination of the programming of television, the global connectivity of the Internet, and the interactivity of the PC. The intercast standard has been developed and promoted by the Intercast Industry Group (IIG), which is a consortium of computer hardware, and software manufacturers, on-line service providers, and television programming networks, including industry leaders such as: AOL, CNN, Intel, CNN, Compaq, Netscape, and Time Warner Communications.

How does it work? Content providers, such as television stations, enhance their existing programming and provide interactive content. This interactive content is 'pushed' via the cable TV wires, along with the TV signal to a PC that is upgraded with an intercast receiver card and software. Intercast content is cached in the computer's hard drive and users can see the intercast programming on their PCs at any time. To receive an intercast broadcast a PC should be connected to a television antenna, a cable TV connection, or a TV-satellite dish. To access the hyperlinks featured in the intercast broadcast the PC should be connected to the Internet via a traditional modem.

Intercast applications are currently limited to complement existing product offerings. An intercast broadcast, for instance, can include extended interviews and videoclips to supplement a nightly news programme, or interactive video games added to a children's television show. Intercast technology redefines in its own way interactive multimedia.

The chief producers of intercasting content are the members of IIG including CNN, and CNBC. Unfortunately, intercasting is only available in some areas.

Streaming video is a live or prerecorded video broadcast that is transmitted over a network or the Internet and presented in real time on the computer screen. Streaming video also can be stored on a hard drive or some other storage device to be replayed at a later time. A PC with a modem and a standard Internet connection is adequate to receive and view streaming video, once the user downloads one of the many free streaming video players available on the Internet. Such videos are found at news- and entertainment-related web sites.

Producing streaming videos, although not cheap or simple, can be done by anyone. One should get the production software package, which may cost $400 to $1400, and obtain (prices ranging around $1000 and up) or contract (prices start from as low as $100) a streaming video server. Nevertheless, streaming video cannot match the quality of television because of the current limitations of compression techniques and bandwidth.

Another interesting venture in the Internet TV applications area is *DirecPC*, the high-bandwidth, satellite-based access medium. DirecPC transmits television broadcasts from major networks, such as CNN, and ESPN to the user's computer system, but it does not combine Internet data with television programming, as intercasting does.

By combining the television programming, the global connectivity of the Internet, and the interactivity of the PC, Internet TV technology develops a new series of services for the home and the office. Such services involve digital TV entertainment, data-enhanced TV programming, and video-enhanced multimedia magazines and can be used for entertainment, business, or educational purposes.

The potential applications range from the obvious—users can read the biography of an actor while watching the movie in which he is the star—to the fantastic—users can watch a featured movie whenever they have the time, instead of when it is broadcast. Additionally, Internet TV enables non-profit organisations and special interest groups to produce their own news programmes to counter the mass media. Equally, entrepreneurs may easily start their own Internet television stations broadcasting programmes to and from anywhere in the world.

Nowadays, Internet TV is a novelty that offers only a few practical benefits for the average individual or business. There are only few application available, which appear to be redundant and unimpressive and very narrowly focused at best. For instance, most of the features of CNBC's intercasts are available on the Internet or are of interest to a very limited number of people.

Due to the generally poor quality of streaming video and the narrow market for producing intercast programming, very few businesses and individuals are producing programmes for Internet TV. Those who are, tend to include high-income businesses and individuals who want to be on the cutting edge of technology, entrepreneurs who see Internet TV as a potentially lucrative investment, and television stations that have resources to explore the technology.

In a few instances, however, Internet TV has been and is being used in an exceptional manner. For example, when the Mars Pathfinder Mission video-taped the surface of Mars, the videos were displayed through streaming video feeds on the Internet. Such a case shows the possibilities of Internet TV.

It seems like the only thing that is currently limiting the capabilities of Internet TV is technology: a lack of bandwidth and poor video quality leave it lagging behind the television and computer markets. As soon as a universal high-bandwidth solution prevails such limitations will no longer exist.

Internet Telephony

Telephone calls via the Internet have already become commonplace. They have been very popular mainly because of their low cost compared to the long-distance or international call prices offered by telcos. Most PCs on the market have currently sufficient multimedia hardware that they can be effectively used for Internet telephony, and Internet telephony software is available for free or at very low costs. Additionally, the sound quality has significantly improved, and the existing customer base of Internet telephony products is significant, especially in groups such as university communities.

There is a wide range of phoneware products, that allow PC-to-PC communication, though the most recent industry activities in this area involve PC-to-conventional telephones Internet communication.

For instance, IDT's Net2Phone Direct service allows users to place international calls at much lower prices than the ones offered by conventional long-distance telephone companies†. IDT deploys its main telephone switches to handle calls placed by PCs and routed to conven-

† The cost of such an international telephone call, from other countries to the US, wll be about $0·10 as opposed to $2 per minute rate offered by a traditional telephone company. MILLER, STEWART. Internet Telephony Implementation Guide, Faulkner Information Services, 1998.

tional telephone sets. Software installed on the PC simply initiates the telephone call. In this implementation there is no need to establish an Internet connection between two PCs that have the same phoneware software in order to set up an 'Internet telephone line'. Such implementations of the past have been very cumbersome at times. IDT is currently improving its Net2PhoneDirect telephone-to-telephone service, and is installing servers in the countries that have been selected to receive such calls. Quality is still not at toll-level, and the product is primarily expected to be used by residential consumers, than businesses.

In the arena of PC-to-PC Internet telephony, Microsoft and Netscape are offering Internet telephony as part of the software platforms.

Finally, in this area where computer software companies have traditionally shown interest, traditional telephone companies are also starting to participate. AT&T WorldNet, for example, is planning to offer an Internet-based long-distance telephone service.

Computer Telephony Integration

Although, CTI seems to have significant growth, its applications area seems to have been narrowed down mainly to call centre implementations or integrated in other equipment such as PBXs instead of being a separate technology.

Its growth has mainly been supported by demands at the work environment, of very large businesses with increased customer support functions. CTI provides the way to apply the power of a computer to the functions of the telephone.

Major communication leaders, such as Lucent, and Nortel are continuously employing their resources and growing their business in this area. CTI functionalities are expected to be integrated in even more devices in the future.

The CTI industry is only beginning to take advantage of the integration of voice and data communications within the LAN environment. The benefits of the integrated voice and data communication networks involve the ability to treat voice messages and electronic messages in unified way and to edit a document with voice annotations.

Internet, TV, and Telephony Convergence—All in One?

During the second quarter of 1999, USWest announced an innovative 'converging' product. Initially named *AtTV* and later christened *Web Vision*, this product is about an original integration of telephone, television and Internet services.

This service will allow users to send and receive e-mail, place and answer telephone calls, surf channels and the Web—or surf the Web and TV channels at the same time—on their televisions. One will be able to check e-mail messages between one's favourite sit-coms, or view caller identifications right on the TV screen before answering the telephone during a crucial plot twist.

The product is still at the technical trial stages, and is expected to reach the market during the fourth quarter of 1999, initially in selected metropolitan areas, and later in the year the product will be launched in regions of several states.

The technology deployed comprises a television set-top box equipped with a speakerphone and proprietary software to receive and make telephone calls and access Internet-based features. Some of these features include programming guides, electronic commerce, news and electronic mail. In addition to access over conventional connections, support for high-speed digital subscriber line (xDSL, VDSL and ADSL) technologies will be provided to offer data-transmission speeds up to 200 times faster than the conventional dial-up connections.

Although the product aims to offer the benefits of Internet access to the households that do not own PCs, through the user friendliness of one of our most familiar household devices (TV), anyone who seeks for the convenience of an 'all in one' communications medium will be delighted by this product offering. Or, better put in the words of Eric Bozich† 'the goal is to make Web tone as common as dial tone'.

Conclusion

It seems that in addition to vendor and carrier activities, the costs of implementation and resulting market place acceptance will play key roles in defining the future of telecommunications convergence.

The potential of such applications is limited only by the imagination. They have the power to make computers and the Internet part of every home and to bring every business or product into every home, by combining the forces of entertainment and computer industry

Until now only minor steps have been realised towards this direction, but there is so much more to be seen in the future.

Biography

Elina Nikaki

Elina Nikaki was born in Athens, in 1972. She completed her undergraduate studies in Computer and Electrical Engineering at the National Technical University of Athens, and her Masters in Information Networking at Carnegie Mellon, Pittsburgh, Pennsylvania. In her professional life, she has had various internships in the telecommunications industry. Among them, she participated in the design of the geographic information system to manage the network maps of the Greek Telecommunications Organisation (OTE). She has also worked for USWest in Boulder, Colorado evaluating alternative technologies to integrate cable and telephony networks. Since September 1998, she has worked as a telecommunications consultant with Deloitte Consulting, in New York. She has been involved in diverse projects involving strategy planning, technology benchmarking, and systems integration in major telcos. Her most recent project entails AT&T's entrance into the local market in Texas.

† US West Vice President of Internet and Applications.