Introduction

Most analysts seem to agree that Voice over IP (VoIP) eventually will change the way telephone services are bought and sold. VoIP will continue to grow as industry standards and technologies evolve. The effect this development will have on consumers and on communications carriers is the central question before us today. Our attention to carriers largely will address the question of how VoIP will reshape the ownerships of companies and the relationships that likely will develop among the industries’ complex web of interrelated players. Our attention to consumers will focus on how VoIP will shape the products consumers may buy, from whom they might buy, and the prices they might pay. Of course, the impact of regulation and public policies on these events cannot be ignored and will be given brief attention as well.

Perhaps the key issue keeping top executives of communications companies awake at night is: “How will the rapidly changing technologies and public policies interact to reshape the communications industry? And how will the changes affect my company’s opportunities to grow shareholder value?” The discipline of economics has its own versions of gravitational forces. Companies merge, form alliances, and agglomerate for economic reasons. Unfortunately, today the true economic structure of the communications industry is masked by the cacophony of political and social noise that guide the world's public policy makers. Until the real character behind the mask is revealed, there will be large windfalls from good timing and right guesses and losses from wrong guesses and false starts. In what follows, we will speculate about the future of communications carriers, using the discipline of economics to guide our conclusions.

Consumers have faced a confusing series of changes in services, prices and communications carriers for the past 20 years. And more confusion is yet to come. As Internet Service Providers (ISPs) and Cable TV (CATV) companies join the newer cellular and traditional wired telephone companies in offering telephone services, the array of available products and prices will further complicate rather than simplify choices. Who will win and who will lose is unknown but, again, we hope to provide a reasoned guess about the future of benefits and costs that may befall consumers.

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1 Drs. Emmerson and Parsons are economists and Mr. Rutkowski is a communications engineer, all are employees of Taylor Nelson Sofres, plc.
In the end, we will conclude that the impact of VoIP on consumers and carriers will be more dependent on price competition and the development of interconnection and interoperability standards than on any underlying economies of scale and scope. The communications market will be highly competitive, fragmented as regards ownership of companies providing communications-related services and related entities, but highly integrated through a variety of new and interesting alliances. Consumers will benefit from an explosion of diverse products and services at relatively low prices. And the general economic benefits of the new communications capabilities will be forthcoming at different rates around the world.

**Technology Overview**

A brief review of technologies related to VoIP will be helpful in what follows. Most important are: the Internet Protocol, circuit switching, VoIP, and voice recognition.

**Internet Protocol (IP)**

IP, as the term is commonly used today, is a coding and addressing system that allows multiple devices connected to a network to communicate with each other. There are other protocols that allow this type of inter-device communication but they are typically proprietary to particular hardware. In part because of its public character IP is becoming the most accepted and widespread protocol for interconnecting diverse proprietary systems and hardware.

However, this same popularity has caused a proliferation of devices to be attached to the Internet using IP and has created an impending shortage in addresses. This is hauntingly similar to the problems being experienced by the telephone industry with area code splits caused by the introduction of competition and the proliferation of new providers of telephone service. While the root causes of these addressing shortages are different (an explosion of devices versus an explosion of providers), the fact that they exist indicates a need for a more robust addressing standard.

Version 6 of the Internet Protocol addressing standard (IPv6, for short) will resolve the problem of a shortage of IP addresses, at least for the near future, by expanding the addressing code from 32 bits to 128 bits. This will increase the number of available addresses from almost 4.3 billion, currently, to over 340 trillion trillion trillion addresses.

While the problems faced by the telephone industry in address shortages do not approach the numerical magnitude of the Internet problem, they are no less severe and distressing to the consumer. A strong argument can be made that the two forms of addressing should be melded into a complete solution that considers ease of use by the end user. Another effort that should be added to this meld is the initiative by the US Post Office to provide an email address for each member of the population of the United States. Perhaps, all of these addressing protocols should be combined into a standard that allows for global identification of devices and specific individuals.
In any case, as voice, video and computer information is combined into new and more varied services, compatible, if not identical, addressing protocols need to be developed.

**Circuit Switched Networks**

Circuit switched networks have been the backbone of the telecommunications network since its inception. The very earliest of these networks is exemplified by the physical connection of the two telephone sets required for Alexander Graham Bell to summon Mr. Watson. This evolved into the concept of having all patrons within a town connected to a central point (the very earliest implementation of a wire center) where connections could be manually made and broken by a human operator. Further evolution brought the concept of mechanically switching these connections and of only dedicating connections between switching centers for the duration of the conversation, thereby allowing more than one user to share the facilities. This is the extent of evolution that had occurred when the Bell System entered divestiture and competitive firms expanded their efforts in providing telephone service.²

The advent of this competition, combined with the dawn of the Information Age (as represented by the Internet), stimulated thought processes on the efficiency of dedicated connections in a voice network. A few years ago, asking a telecommunications engineer what type of switch would be used to replace an existing switch that was destroyed by a natural disaster would yield such answers as a Lucent 5E, a Nortel DMS-100, an Ericsson AXE-10, etc. Asking the same question this year will likely yield responses such as a Nortel OPTera, an Ericsson AXD-300 series, a Lucent 7R, etc. These are all ATM protocol packet switches. It is apparent that telecommunications engineers are recognizing that the network is involved in another evolution, but this time towards a connectionless environment.

**Voice over Internet Protocol (VoIP)**

VoIP is not a technology, *per se*. Rather, it is the provision of voice grade telephony service by the utilization of several new technologies. A more descriptive term is Voice over Packet (VoP). The crux of this confusion lies in the convergence of several external impacts. First, there is the rapid expansion of new competitors providing voice telephone service searching for more efficient mechanisms to provide a cost advantage and/or expanded opportunities for revenue generation. Second, is the expansion of cellular

² Competition in the U.S. telecommunications industry had a long slow beginning. Some of the key legal/regulatory/market invents include the following: 1955/56 Hush-a-phone (terminal equipment attachments) case decided; 1959 FCC decision “Above 890 megahertz” decision (allowing private microwave carriage); 1962 MCI applies for entry; 1965/68 Carterfone case decided (involving attachments to the network to complete mobile communication); 1971 final grant of MCI to enter and Specialized Common Carrier Decision (opening the door for other dedicated circuit providers); 1973 FCC allows full competition in terminal equipment and pushes for standards (e.g., RJ 11 phone jacks); 1975/76 MCI offers switched services under “Execunet.”
services and their popularity with the public. This has led to experimentation with voice coding structures to conserve scarce bandwidth. Third, and not the least important, is the pricing structure for long distance and international voice calling and its comparison to the apparent flat rate communication service pricing of the Internet providers.

All of these factors have combined to speed the creation of a mechanism to “packetize” voice communication. And while it is not unusual to blur definitional lines between technologies and protocols, VoP falls more into the protocol category. This, of course, is a technical distinction and the perception of VoIP as a new technology will probably continue.

Perceptions aside, Voice over Packet is having profound effects on the provisioning of networks and the deployment of advanced technologies. More and more of the embedded communications network is to be converted or adapted to allow the provision of voice communication over a packet switched protocol, most visibly represented by the Voice over Internet Protocol. It is merely a matter of time before the telecommunications network and the Internet merge into one network where the separate parts are indistinguishable and appear seamless to the end user.

**Voice Recognition**

Voice recognition today is in a state that might best be termed its “adolescence”. By this, we mean that there are working voice recognition applications, but there is still a significant amount of growth needed before they are generally accepted into society. However, as in all adolescents, there are unexpected growth spurts that occur. The communications industry seems poised on the edge of one of those growth surges.

In today's environment, there are two primary functions being performed by voice recognition applications. One of these is the reduction of labor expense by the substitution of software for human interactions. This is best exemplified by the automated directory assistance systems that are beginning to be deployed widely. The second function is providing users with a different interface option to mechanized customer response systems. This allows the user to interface with the system either through pushing a key on their telephone set or to enter their response verbally. The latter function will lead to more substitution of the human interface as users become more accustomed to interacting verbally with a mechanical system.

The potential implications for the telecommunications industry are immense. At some point in the not too distant future, the familiar old dial tone will be replaced by a friendly voice asking, “How can I help you?” These types of applications will likely first appear in the mobile communications industry as safety concerns grow regarding dialing and handling a phone while driving. However, their acceptance in mobile communications will lead to rapidly increasing demand to implement similar systems in non-mobile communications. Telecommunication companies would be well advised to monitor these trends closely.
Economic Forces

Firms relate to one another in many ways for some common reasons generally described as “economies” of one sort or another.

Agglomeration economies cause firms to locate near one another because consumers find it more convenient to consolidate buying behavior that tends to occur with similar frequency and at similar locations. Thus the grocery store is likely to be located near an Automatic Teller Machine, a dry cleaner, or a pharmacy.

Economies of scale provide firms with efficiency advantages and lower costs because the capacity to produce can be expanded at lower incremental cost as total production expands. In the range of economies of scale, bigger is cheaper. Thus the per unit cost of producing a specific model of automobile, for example, is likely to fall with larger production quantities.

Economies of scope make the production of two or more goods together more efficient by sharing some volume insensitive inputs. Thus some companies tend to produce a variety of products that rely on microelectronics rather than specialize in one product, and Honda produces many products that are “wrapped around” engines.

There are financial reasons why companies consolidate. Bulk discounts on resource purchases cause cooperatives to form or firms to integrate. Economies of scale in legal functions, human resources, tax preparation, and capital acquisition can lead to larger firms. In some instances the ability to spread risk by selecting the right portfolio of production activities can reduce the cost of money.

Firms may vertically integrate in order spread financial risk, to reduce transactions and contracting costs, or to maintain quality control and brand capital.

And finally, some companies come together for little apparent reason, although the resulting mergers tend to be short lived. For example, airlines have tried to consolidate related businesses such as rental cars, hotels, etc. with very limited success.

Just how does one know what forms of mergers and consolidations make sense in each environment. More to the point, will cellular telephone companies merge with makers of “palm” devices or with cable-laden telephone carriers? Will financial transactions made over wireless networks bring together credit card companies and wireless carriers? Will telematics (as applied to make smarter automobiles) bring communications companies into exclusive alliances with auto manufacturers? And how might VoIP influence the attractions and repulsions of these fluctuating forces?
VoIP sits at the heart of many of these questions. If, as some prognosticators foretell, VoIP will make voice traffic incidental to services demanding greater bandwidth, telephone companies as we know them today will go the way of Western Union (which once rejected the telephone patent as merely a device that would serve to call the local telegraph office to send telegrams). ISPs or their mutant offspring will carry on, having displaced the dinosaurs. Contrary to this view is the belief that future communications pricing will be based on packet priorities making two-way real-time voice traffic, videoconferencing, and the like highly profitable services of traditional telephone carriers who, with their newly built packet networks that handle VoIP, will in turn absorb related broadband services. These competing views thrust ISPs, wireless carriers and wired telephone assets (and perhaps the intellectual property of content and applications providers) into direct competition with one another with no clear dominance that will foretell the future nature of the communications industry.

**The advantages and disadvantages of VoIP**

There are several obvious characteristics of VoIP that must be considered.

First, circuit switched networks are hopelessly inefficient for carrying combinations of voice and data traffic. Packet networks based on digital technology appear to have won future dominance in both efficiency and interoperability of communications systems. The reasons for this are well known and need no further attention here.

Second, the Internet has taken on a “public” character that makes it available to almost anyone in the world having a network access device (e.g., a personal computer) and an Internet access service. Packets of voice fragments are as readily transported throughout the Internet as are any other packets; from the perspective of consumers having Internet access, the only significant characteristics causing Internet Telephony to be inferior to circuit switched telephone connections are: 1) the lack of priority handling of real-time voice traffic (thus quality of service is low today), 2) the lack of standard published IP addresses (like telephone numbers) for making telephone calls, and 3) the lack of standard devices that are as simple and easy to use as a telephone. Nevertheless, there are significant differences between direct dial rates (e.g., for international calls) and VoIP rates for the same calls; largely attributable to the fact that incremental traffic over the Internet is generally free, once access is established, and firms providing Internet telephone calls using the local telephone charge much less than circuit switched carriers.

Finally, communications technology is advancing so rapidly that the cost per packet transported almost anywhere in the world (at least where the Internet exists) is fast approaching zero. Packets will not become a commodity. Rather, they will be priced with regard to their size, content value, and priority handling. Thus new pricing

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3 Content providers will price packets based on the expected value of the packet to users. Information network operators (i.e., those firms transporting packets) will likely price packets based on their size and their priority.
Paradigms will be needed to make the Internet a self-supporting component of the world’s infrastructure.

Setting aside for the moment the problem of a limited number of people in the world having telephone access, the defects of VoIP cited above are about to be overcome. The Quality of Service (QOS) efforts presently underway together with revisions to the Internet Protocol itself (e.g., IPv6) will soon offer priority handling of packets that will resolve the transmission quality problems currently facing VoIP. IP addressing matters are also being resolved so that not only will IP addresses be richer and more flexibly assigned than telephone numbers, but telephone numbers themselves can be subsumed into the Internet addressing function. Lack of direct access to the Internet is no longer a serious obstacle to VoIP. Today, VoIP service providers offer local (often free) telephone access to VoIP through local access numbers. That is, ordinary telephones can be used to make VoIP long distance and international calls. And customer premise devices are under development that will allow: 1) ordinary telephones to be used in ordinary telephone outlets to access the Internet directly through an ISP; 2) ordinary telephones to be plugged into the newest generation of personal computers; and 3) the newly developing industry of “net appliances” to make simpler and more flexible uses of the Internet that can communicate without human intervention at all. In short, the current limitations of VoIP will be short lived.

Of course, the question remains: how will VoIP affect consumers and Carriers of telephone services? But before addressing these central questions, the economics of “standards” requires brief attention.

The Economics of “Standards”

Innovation and new product development can be hindered or stimulated by the lack or presence of standards that allow “interoperability” (the term in quotations is used here to mean the ability to create products or services that can connect seamlessly to create a “super-product” that has value greater than the previously unconnected products or services). For example, the rate of new product development in telecommunications has increased rapidly following the slow initial introduction of competition into the U.S. long distance business. Much of the accelerated development of new telecommunications products can be attributed to the innovations brought about by allowing multiple companies to participate in what was before a legal monopoly. This in turn required that new services (e.g., wireless communications) be integrated into the existing network by developing appropriate standards.

At the heart of the AT&T case for divestiture was the question: would divestiture of the local from the long distance telephone business sacrifice economies of scope or scale? AT&T claimed that the entire telephone network “can be planned, constructed, and managed most effectively by an integrated enterprise the major piece-parts of the facilities network and maintains research, development, manufacturing and systems
engineering capabilities.” [In essence, AT&T claimed that economies of scale and scope would be lost under the divestiture plan; standards allowing interoperability would not be sufficient. In retrospect, such an argument sounds unappealing but at the time, much research and highly sophisticated statistical analysis produced ambiguous results.]

This question is very pertinent today: “are there significant economies of scope in telecommunications that are not overcome by the development of standards allowing interoperability?” If the answer is “no,” then there is little likelihood that significant mergers and acquisitions will serve to consolidate diverse businesses such as ISPs, telephone companies, content providers and other components of our global telecommunications industry. If the answer is “yes” then the right combination of strategic acquisitions will bring significant value to the shareholders of the business(es) that undertake the complementary mergers. Indeed, there is even the prospect that businesses having such economies today, may not have them tomorrow. For example, if all information eventually is most efficiently transported on a packet network, then businesses now built around distinctions such as voice vs. data, narrow bandwidth circuits vs. broad bandwidth circuits, etc. may further fragment leaving behind tattered remnants of our present telecommunications system.

The implications for businesses directly affected by VoIP are great. 1) Voice packets are tiny compared to many information flows – might they become free byproducts of large bandwidth systems? 2) Will regulations that govern telecommunications across jurisdictional boundaries be circumvented by disguising voice packets as data packets thereby avoiding taxes or public policy charges? 3) Will there be so many means of moving voice traffic from place to place that no jurisdictional boundaries can be extended far enough and fast enough to maintain regulatory oversight of telecommunications? 4) Will voice-based services (e.g., voice recognition) be so cleverly integrated into other products that voice service cannot be distinguished as a final service at all?

Before addressing these questions, a little background on standards in telecommunications will be useful. In the telecommunications industry the term “standards” has come to mean several things and has come to be applied in four types of areas: 1) technical standards; 2) service standards; 3) public policy standards; and 4) general business standards. The focus here is on technical standards.

Technical standards are typically developed by industry consortia, engineering associations, or other bodies with a high degree of technical and engineering expertise. These include such organizations as the International Telecommunications Union (ITU), the Institute of Electrical & Electronics Engineers (IEEE), the European Committee for Standardization (CEN), and the International Organization for Standardization (ISO).

4 AT&T, Defendants’ Statement of Contentions and Proof, p. 35.]
5 Breaking Up Bell, David Evans, Ed., 1983
6 (http://www.itu.int/)
7 (http://standards.ieee.org/index.html)
8 (http://www.cenorm.be/default.htm)
There is debate over the degree to which free market activity will lead to some degree of standardization of technical applications. Eli Noam (Columbia University professor and well-known telecommunications analyst) states: “Will market forces be sufficient for a convergence [to technical standards]? Not always. Economic theory suggests that it is impossible to say in advance whether a convergence to compatible standards will take place. Where it does not occur one must weight the cost of incompatibility against the benefits of flexibility.”

Governmental agencies may choose only to play a role of coordination of industry participants in developing standards. Alternatively, governmental agencies may exert greater control. One motive for the mandatory development and government oversight of interoperability standards is a belief that such will not be forthcoming from the natural market forces of competitive private enterprises. Another motive is the belief that there still exists market power in the incumbent industry and that natural market forces are largely inoperable. In any case, there is a significant effort on behalf of many governments and organizations like the World Trade Organization to develop and enforce standards for interconnection and interoperability of diverse communications systems.

In addition, a large number of voluntary efforts to develop standards are underway. A few examples of efforts that may affect VoIP are:

- IPv6 – IETF (Internet Engineering Task Force)
- Telephone Numbering – NANC (North American Numbering Council)
- CEBus Standard (In-home networks) – CIC (CEBus Industry Council)
- ATM Protocol – ATM Forum
- IP QoS – QoS Forum
- Telecom Standards – ETSI (European Telecommunications Standards Institute)
- Telecom Standards – TIA (Telecommunications Industry Association)
- Telecom Standards – WTSA (World Telecommunications Standards Assembly)
- Telecom Standards – TSACC (Telecommunications Standards Advisory Council of Canada)
- 3G – ARIB (Association of Radio Industries and Businesses)
- 3G – ETSI (European Telecommunications Standards Institute)
- 3G – ATIS (Alliance for Telecommunications Industry Solutions)
- 3G – UMTS Forum
- 3G – UDP (UMTS Development Partnership)

9 [http://www.iec.ch/]
Indeed, it is hard to find any industry that has undertaken such extensive and intensive development of interoperability and standards as the communications industry.

It is easy to confuse the benefits of standards with economies of scale and scope. For example, scale economies yield efficiencies only if the scale of production processes are either physically integrated in ways that cannot be disentangled into equally efficient smaller parts (as with large scale businesses using mass production techniques) or combined under a common financial structure (as with discounts made available to Cooperatives and large firms). A firm integrates in part to reduce the search and transactions costs caused by the existence of multiple firms. In some sense, standards can reduce search and transactions costs (and risk as well) without financial and/or physical integration. Standards can facilitate expanding the scale and scope of production by allowing separate research, production and management processes to be effectively combined without having a common financial structure or having fully integrated operations. Examples of separable operations are everywhere: auto manufacturers outsource information systems and manufacturing of parts; banks interoperate by accepting checks written on competing banks’ accounts; hand held phones are made with display devices manufactured by firms specialized in displays for electronic devices, and so forth.

In some cases, standards might be used to exercise market power thereby consolidating businesses that could operate separately. Microsoft has been accused of managing the interconnection of competitors’ software with their proprietary systems in ways that maximize Microsoft’s market share at the expense of competing firms. AT&T certainly used its “monopoly” position in the telecommunications market to limit interconnection of other devices. While such practices are often profitable for the consolidator, they are not generally sustainable in the face of the full forces of competition. In the end, the largest company on earth (AT&T prior to divestiture) was to succumb to market forces (i.e., its attempts to enforce proprietary “standards” was not sustainable in the market). Moreover, the mandatory use of proprietary intellectual property does not fit the classic concept of standards.

The ability of firms to acquire and use market power cannot easily be predicted. The best an economist can do is to base predictions about the future on the natural forces that hold businesses together or force them apart. The natural forces in telecommunications and VoIP form the foundation for our conclusions.

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11 AT&T once tried to prevent the connection of a plastic acoustical device to handsets arguing that the integrity of the network might be jeopardized -- an interesting history of AT&T’s exclusionary practices can be found in “Telephone” by John Brooks.
The future of VoIP

With the above background in mind, we can begin to speculate about the future.

It is very likely that telecommunications will face a major paradigm shift in the near future. And this could be dangerous for traditional telecommunications businesses. Such a shift has occurred in the past. Western Union, having concluded that telephones would be useful only to make local calls rather than long distance calls (the exclusive purview of the telegraph) was very “telegraph-centric.” The FCC in allowing the private use of microwave (the above 890 megahertz decision in 1959) and related decisions focused on “private line” services, while helping to usher in switched services competition and distinctions between the two blurred. Telephone carriers today view the telephone network (both wired and wireless) as a means of accessing the Internet. Cable TV companies tend to do the same with respect to their core technologies.

Just as Western Union became unproductively entrenched in the telegraph technology of the day, there is a real danger that some telecommunications companies are too “circuit switched network-centric.” More fundamentally, there is a real danger that telecommunications companies are too “communications centric.” For example, today telephone companies view the existing communications networks as a means of accessing the Internet and related services and undertake expensive programs to build faster and better access technologies. Wireless carriers spend large amounts of time and money expanding bandwidth to facilitate streaming video and visual user interfaces. This communications-centric view of the communications market, coupled with confusion between economies of scope and the value of standards, could lead to futile and financially disastrous attempts to consolidate “convergent” businesses. But what is the alternative view?

The alternative view is an “info-centric” view of the world. New generations of products and services are being constructed from information components. Information of all sorts ranging from DNA to digitized sounds (including voice) is very efficiently transported in packets. These packets can transport the elements of movies, voice conversations, machine instructions or even genetic codes that instruct normally inanimate material to spring to life. While packets are not the only means of coding and transporting information, they provide the primary standard construct that allows the packaging and bundling of information into useful products and services using the science of today. But packets by themselves are little more than miniature commodities, not unlike electrons carrying electricity. Indeed, the analogy to electricity, while incomplete, is instructive for considering the supply side of the market.

Electricity runs appliances that are developed around a few standard voltages and “protocols” such as current that alternates at prescribed clock rates. Electrical appliances are produced and sold by thousands of firms that use these standards to innovate new products and services. It is obvious that economies of scope among electrical appliances do not exist by virtue of the common use of electricity. Packets care not whether the
ultimate use of information is entertainment, a legal document or a friendly conversation. Packet transport technology is evolving to distinguish packets by priority, size, and other quality characteristics (such as security). These packets flow in complement with electricity to allow the creation of increasingly sophisticated new products and services.

On the demand side of the market, the electric power analogy is not useful. With packets of information, the consumer values the end result, not the hidden means of accomplishment.

To see what the info-centric view of the world might mean to consumers and communications carriers, consider a couple of possible future scenarios. A business receives a bundle of information over fiber optic cable. The bundle is priced based not on traditional “minutes of use” but on the size of the bundle, priorities that are assigned to the packet transport, the required level of security, and the information content. The information bundle may consist of legal documents, instructions to various premise devices, a voice conversation or videoconference, and a financial transaction. Many firms may ultimately receive revenue from the price of the bundle including the network facility owners, software companies selling services “per use” of applications software, banks involved in the financial transactions, providers of devices at the ends of the communications and the creator of the documents. Again, there is little reason to believe that any of these entities are sensibly combined in operations or ownership; standards could allow all the interoperability that is needed.

Consider a second example: mobile wireless companies are investing heavily in broadband Internet access to provide various multimedia services such as streaming video and other visual media. Not all industry analysts are optimistic about this placement of funds. For example, telecommunications futurist Bruce Egan, (author of the book "Information Superhighways" (1991) and "Information Superhighways Revisited: The Economics of Multimedia" (1996)) believes that moneys would be better spent in mobile communications advancing digital voice technologies (of which voice recognition is one) rather than video-based technologies. He states that the next "killer app" for the broadband Internet is the same as the last killer app, namely e-mail. Only now e-mail is in the form of voice communications using sophisticated (and bandwidth hungry) technology (including artificial intelligence) to convert text to speech and to support machine-to-human interactive communications for transactions and conversation. Egan states that his prediction is consistent with the incredible growth of the first generation of e-mail communications and the large pent up demand for a more convenient way to communicate naturally using the more natural voice and hearing rather than cumbersome keyboards.

The Impact of VoIP on Carriers

Voice over IP likely represents only a small change in how voice traffic is addressed and transported; but it represents a big change in how information will form new building
blocks for unforeseen products and services of the future. And there will be significant near term impacts on communications carriers.

IP technologies such as Routers and “soft switches” will soon replace circuit switched network equipment. Traditional incumbent telephone companies have a very few years to depreciate their networks resulting in huge depreciation charges or capital losses. Many telephone companies are heavily dependent on excessive (compared to market-based) international call charges. Significant rate rebalancing will need to be accomplished in even fewer years as VoIP provides increasingly effective means of circumventing high toll charges, especially with the improved voice quality that will accompany better prioritization of packet transport and switching.

The impact VoIP (and other uses of data networks to substitute for the public switched telephone network) is already evident. Domestic long distance prices have fallen significantly over the last two years in the U.S., Western Europe and many other countries. In recent years international L.D. rates and international settlements rates have fallen in response to competitive pressures and pressures by the FCC and the World Trade Organization. Even by 1999, many countries had already reduced their international settlements rates below the FCC’s benchmark (e.g., Belgium, Denmark, Singapore, Israel, Kuwait, Netherlands, UAE, and Hong Kong). Therefore, while VoIP has grown significantly in recent years, its growth has been depressed due to reductions in domestic and international L.D. rates. These reduced rates may be caused in part by traditional carriers responding to the threat of VoIP.

The rapid growth in domestic and international transport capacities means that the downward trend in long distance rates is likely to continue into the future.

The potential for VoIP is greatest in those countries that have a significant proportion of international long distance calls that continue to have very high international settlements rates. Countries such as Viet Nam, with very high international settlements rates and nearly nonexistent Internet access, are vulnerable to VoIP, especially as the availability of Internet service expands.

Mobile telephone companies will have difficulty keeping up with new innovations in digital voice technologies if they continue to concentrate on video technologies. Other wireless carriers (e.g., fixed wireless facility owners) will find it difficult, even impossible, to reach into businesses in which the core competencies are very different than wireless network engineering and management.

And, perhaps most importantly, carriers that try to build business entities around ownership of so-called “convergent” technologies will likely fail. While there may be a convergence toward information-based packet switching networks, this is likely to be

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achieved via standards and broad-based protocols. Each new component of the “convergence” wave has its own need for concentration and focus; location services for mobile communications, navigation and “telematics” for automobiles, voice recognition technologies and so forth each are complex businesses in their own right requiring different core competencies. The natural gravitational forces of economics, economies of – you name it – don’t appear to be strong enough to hold together such diverse businesses. Perhaps the contrary is true: the core competencies required to succeed in each field of the information industry may be so different that consolidation of businesses may be doomed to failure.

The best that can occur is for the rapid development of open communications and information technology standards to greatly expand the variety of businesses that can develop based on the shifting whims and needs of consumers.

This does not mean that communications carriers are destined to become the Western Unions of tomorrow. It does mean that carriers will need to develop a solid understanding of: where and when economies of scope make sense, where and when standards that promote interoperability are needed, and how to manage diverse holdings in more decentralized and flexible ways.

There will certainly be new opportunities for providers in the market place. In many instances, the opportunities will come in the form of creating, or manipulating information. While there may be unprecedented opportunities for new entrants, traditional providers may be able to branch out in new ways (e.g., IBM’s recent television ads offering a $500 web site starter kit).

As noted earlier, standards are likely to greatly reduce the economies of scale and scope due to the consolidation of activities into a single enterprise. However, with the proliferation of new providers, changing firm affiliations and changing firm names (e.g., Verizon), the brand name recognition of existing reliable participants may be the one remaining source of economies of scope.

The Impact of VoIP on Consumers

As quality differences between VoIP and circuit switched telephone calls erode, VoIP will quickly undermine the ability of international calls to provide subsidies to other segments of the business. The same will be true for long distance calls but those effects are already being felt (long distance calls anywhere in the U.S. at any time can be made on the Public Switched Telephone Network – the PSTN – even by residential customers for as little as $.04 per minute today). This is due in part to growing competition from VoIP competition. A recent article featured in Telephony addressed the differences in quality of service between VoIP and circuit switched services:

13 Sprint has recently run television advertisements for off-peak calling packages for as little as $.02/minute.
“…the lure of IP networks operating at one-fifth to one-tenth the cost of a circuit-switched network has added billions of market capitalization to IT businesses.”
The article went on to say:

“Service features and quality of service (QOS) may not be the same, but the price performance gap is closing rapidly for consumers and businesses.”

New forms of least cost routing will make the selection of a carrier for timed calls automatic, perhaps allowing the consumer to select automatically the lowest price available for a specified quality of service. It is likely that new billing capabilities will make least cost routing obsolete; imagine “least cost billing,” a capability that is a reality in billing calls from mobile phone based on the location of the caller. Some industry analysts believe that voice calls around the world will eventually be made available in low priced “flat rate” packages eliminating the price advantage of low per-minute rates altogether.

Dr Paul Rappoport, a widely respected economist and telecommunications research specialist, suggests that the trend in price elasticities indicates the incremental price of a voice telephone call within the U.S. is rapidly approaching zero. Indeed, some of the world’s largest traditional long distance carriers have seriously considered divesting the business of carrying traditional toll calls altogether.15  Certainly, the trends in transport capacities, capital spending, and ratios of revenue to capital spending suggest that voice communications prices must fall further.16

As voice recognition functionality is integrated into VoIP, new and exciting services will become available. It is possible today to translate e-mail into voice and voice into e-mail, allowing mobile e-mail access and response. E-mail programs are incorporating the ability to send voice as voice without translation. Language translation software is facilitating both written and spoken communications across international boundaries. Voice-only vehicle navigation systems are available in local retail stores. But this is only the infancy period of the digital voice industry. VoIP and its various applications that could be made possible with new devices stagger the imagination. Just as electrical appliances initially served largely to save time (and later provided entertainment to fill the newly found time), time savings and entertainment capabilities using digital voice has yet to mature. Voice commands initiated from anywhere could pay bills, reschedule travel, coordinate schedules, make purchases, command appliance functions and much

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15 Part of the rationale for such divestitures is increased ease of mergers in other areas. However, this does not diminish the implications of such divestiture – voice communications has become a thin-margin more commodity-like activity.

16 See, for example, “Telecom Sector Overspending is Hurting Sector, Lehman Says” *TELECOM A.M.*, Vol. 6, No. 172 -- September 11, 2000 (regarding rises in capital spending and low revenue/spending ratios).
more. These applications emphasize voice commands by consumers. Services built on voice responses back to consumers are equally underdeveloped.

VoIP likely will allow new forms of retail businesses. Information “boutiques” are being created daily thanks to the Internet. The Internet and its companion, VoIP, provide opportunities for small companies to become giants overnight. For example, SignalSoft (ticker symbol SGFS), a boutique service provider specializing in services that depend on knowing the location of a mobile phone, recently completed an IPO. With historical annual revenues less than $2 million (US), it now has a market value of about $1 billion U.S.

While the digital voice industry fueled by VoIP has enormous potential, it is not without risks. For example, should consumers discover that wireless technologies present a significant health risk, businesses that have become overly dependent on mobile wireless communications could experience serious fallout. Boutique firms would do well to invest in device-independent applications. To mitigate this particular risk, digital voice capabilities can be made useful in fixed locations that have wired or fixed wireless access to the Internet, in automobiles, and in other ways that mitigate potential risks of holding microwave transmitters close to one of the most important organs in the body.

Nevertheless, consumers are in for a bewildering array of information-based products and services in the near future. Confusion can be avoided if communications and information technologies are kept in the background, leaving only the consumer benefits to be obvious and easily understood. This suggests that firms, such as AOL, specializing in user-friendly interfaces between the customer and the array of products and services brought to that customer (in turn, likely produced by many other firms) may become the most successful information retailers of the future. Just as the grocery store sells but does not produce its products, there may be many innovative and interesting companies behind the information “storefront.”

If consumers have had one nearly universal complaint about the development of voice communications thus far, it is the confusing array of charges that appear on bills. While a number of confusing charges are due to the political motive of disguising jurisdictional taxes, it is nearly impossible for the typical consumer to compare the charges of one carrier to another. In voice long distance the recent trend has been toward more simple pricing structures. Certainly, over time, information providers (and transporters) will respond to customer’s billing preferences. If providers do not respond themselves, it is likely that companies specializing in customer billing will come to the rescue. Not only can such companies provide benefits to consumers (recall the earlier reference to least cost billing), but the business that controls the bill, controls the customers’ businesses. A billing agent could negotiate with substitute suppliers of communications services (relegating those businesses to commodity providers) while usurping the profits on the retailing function. This would further fragment ownership of the underlying provision services while simultaneously simplifying life for the consumer.
Impact of (on) Regulation

To date Internet service has been largely immune to regulation in the United States. More importantly, Competitive Local Exchange Carriers (CLECs) serving Internet providers have had favorable state decisions. While the FCC found that Internet traffic was best categorized as interstate traffic, State Commissions have continued to consider Internet traffic subject to reciprocal compensation for the transport and termination of local traffic. This has created large payments from ILECs to CLECs serving Internet providers and therefore to highly favorable CLEC treatment of Internet providers. This has helped stimulated the growth of Internet service providers in the U.S.

In the long term such asymmetric treatment of technologies will be unsustainable. The regulation, taxation and pricing of services must become more market based. In the case of regulation, this means that regulation must generally be reduced and in many instances eliminated.

The traditional pattern of cross subsidy in the United States (as well as much of the rest of the world) continues to be one of the biggest stumbling blocks to meaningful competition in the changing communications/information markets. The traditional subsidization of basic local exchange service must be eliminated or replaced with very broad-based universal service funding. Surprisingly little progress has been made in this area over the last four years.

Without these fundamental changes, the traditional providers (those providing both the services providing the cross-subsidy and those receiving the cross-subsidy) will be handicapped in the market place. In addition, with such changes, market signals to consumers will be distorted as well.

Some foreign countries have looked unfavorably on VoIP. In particular, countries with high interconnection rates have recognized that VoIP represents a major threat to high contribution levels from international long distance service and a threat to traditional patterns of cross-subsidy.

Some countries find the free flow of information on the Internet inconsistent with political agendas. However, in the long term, competitive forces and the value of the free exchange of information will dominate. At best, regulatory policy will only have a minor affect on the direction of these forces and the timing of their effects.

Conclusion

If we look behind the curtain of public policy dressed in its diverse laws and regulations, we see less rather than more gravity drawing the communications industry into operational or financial consolidation. Neither vertical nor horizontal integration of communications-related businesses appears compellingly natural. Instead we see a
growing value in cooperatively developed integrative standards that will marry such distant cousins as content to conduit, computing to transportation, appliance functionality to communications. The natural forces that bring companies together are dissipating in the communications and information technologies industries. The rate of technological advancements (and apparent lack of economies of scale that such behemoths as Bell Labs once enjoyed) allows industry giants to be toppled at unprecedented rates. Core competencies that form much of the force of economies of scope are becoming increasingly narrowed and specialized, leading us to industry fragmentation in the information revolution contrasting against the industry consolidation that accompanied the industrial revolution.

The present rate of technological change in the information and communications industries also stimulates new product possibilities that are more easily captured by small entrepreneurial firms rather than large, highly structured corporations. The industrial revolution benefited from scale economies because the business focus was on mass production of a few products that had obvious mass appeal (the automobile, electrical appliances, etc.). The rate of development potential for information-related products is orders of magnitude larger and the mass needs are much less obvious. Thus, consolidation of firms has greater value in its portfolio effect than in economies of scope and scale (the uncertainty of just which information and communications products will be successful carries risks that can be mitigated by having a portfolio of such products). But to preserve the different core competencies of the portfolio on businesses, new management styles and techniques, new forms of alliances with competitors and suppliers, and new open standards of interoperability will need to be developed.

VoIP and other digital voice applications will prosper both as an intermediate goods in other information products and as a component of many retail services. It will be coupled with other applications such as location-dependent services, e-mail, appliance commands, and so forth. But it will not be just another way of making voice telephone calls to avoid high toll charges on the circuit switched network.

Perhaps the greatest challenge to carriers is to become less communications-centric and more info-centric, perhaps abandoning altogether the management of two-way voice traffic as a main line of business. A subsidiary challenge is to find new ways to manage increasingly diverse: portfolios of businesses, portfolios of networks (both wired and wireless), portfolios of development projects, portfolios of packaged products and price offerings, and portfolios of alliances with others connected by ever-evolving standards.

For consumers, there are enormous benefits ahead: nearly free traditional voice telephone calls, simplified billing with more products and services available, and a rapidly growing array of ways to save tedious time and to use entertaining time in new and exciting ways. One of the potentially surprising outcomes of VoIP in particular could be a new emphasis on the Internet’s stepchild: auditory information exchange. If investment and attention is given to the possibilities of digital voice technologies, especially in the mobile environment, an entirely new and useful set of products and services is yet to be realized.
Finally, regulation can help consumers most by getting out of the business of micromanaging communications and instead facilitating the development of open standards that will allow a proliferation in information products and services to be appended to the information and communications networks of today and tomorrow.