

# ***Industry Outlook Report***

## **The Telecommunications Revolution**

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The global telecommunications industry is embroiled in fundamental and revolutionary change. To a degree unprecedented in history – and unequaled in any other industry at this time – telecommunications industry participants are facing a revolution in the basic technologies used to build and operate the network as well as the opening of their protected monopoly markets to full, unfettered competition. Both operators and equipment suppliers face new competitors with billions in financial backing, multiple mergers and acquisitions around the globe, and a shift to completely new business paradigms. In the face of this onslaught, the incumbent telecommunications companies are forced to rationalize costs, make their organizations more efficient, and deal with markets that are becoming ever more articulate in their demands. For some industry observers, the wave of change sweeping the industry feels nothing short of apocalyptic.

We are more sanguine. While detailed forecasts would be foolhardy at this point, a converged telecommunications industry is becoming visible on the horizon – one in which telecommunications services combine with content provision and transactions services, delivered by means of powerful and cost-efficient communications-and-computing technologies. These technologies will make possible innovative services based on clear value propositions designed to meet the increased expectations of both businesses and consumers.

To survive and thrive in this industry, companies must use change as a strategic weapon. In this article, we offer a brief overview of the forces driving change in six areas:

- Market demand and customer needs
- Technology dynamics
- Infrastructure issues
- Capital market conditions
- Regulatory conditions
- The competitive landscape

### **Market Demand and Customer Needs**

As business customers for telecommunications have demanded better services at ever-lower prices, the traditional telecommunications companies have been slow to recognize that their time-honored approach to segmenting their business customers into large, medium, or small enterprises is no longer adequate. The telcos need new ways to segment the customer base that reflect customers' different demand profiles. For example, small-business customers operating Web sites are likely to demand high-bandwidth connections similar to those used by businesses many times their size. Along the same lines, certain residential customers, particularly those participating in work-at-home activities, may transmit as much data as they receive, thereby requiring symmetrical broadband connections instead of the asymmetrical connections favored by more typical residential customers. In the broader business arena, some customers (e.g., in the travel and financial industries) are willing to pay a huge premium for reliability and availability (and hence backup) of telecommunications, while others (e.g., some manufacturing operations) will pay more attention to prices.

Some telecommunications companies are moving in the opposite direction by developing one-stop-shopping concepts or bundling their services. In doing this, they hope to gain greater proportions of customer expenditures on telecommunications applications and services and to prevent customers from defecting to other service providers. But some customers don't want bundled products and services, and among those who do, needs and preferences vary widely.

The telecommunications service providers still have a lot to learn about customers and their needs profiles. In the future, service providers will certainly have to offer more than technically defined services. The business world will demand more customer-oriented solutions designed to solve their business problems. With regard to the mass consumer market, questions of customer loyalty and readiness to change service providers will be the focus of interest.

Among major long-distance carriers in the United States, chum rates – the percentage of customers switching to a new carrier in any given year – can approach 30 percent, demonstrating a lack of consumer loyalty. Companies are offering customers cash bounties or an award of airline frequent-flier miles to secure new long-distance business. Indeed, mobile wireless carriers are beginning to experience chum rates similar to the long-distance industry. The bounty for mobile, usually in the form of a free or cost-reduced handset, is typically in the

neighborhood of \$300. The regulatory requirement for portable telephone numbers across carriers serving a specific geography is expected to facilitate churn for local service as well.

In response to these challenges, the telecommunications industry will have to develop new forms of marketing and distribution that convince customers of the superior value of the services they are receiving, offer excellent customer service, and give customers the impression that they are working with reliable and competent service providers. While churn rates can provide information on where customers are going, these measures reveal nothing about qualitative changes in customer behavior. To achieve effective customer management, telecommunications service providers must know:

- What customers are buying
- In what form they buy these services
- How they buy these services
- How many customers are prepared to pay how much for these services

In times of price competition, the last question becomes especially relevant. It is important to understand how far price competition can stimulate other changes in market demand, with respect to both service volume and composition of the services in demand. Long-distance volumes increased when the United States deregulated its telecommunications market. Similarly, when America Online introduced flat-rate pricing for consumer connections, demand quickly overshot capacity, resulting in long delays for access to its modems. The same situation occurred in mobile telephony when AT&T introduced its „One Rate“ plan: a flat-rate charge, independent of long-distance, time of day, or roaming charges. Today, during periods of high demand in high-traffic areas, e.g., key airports and highways, it may be difficult for an AT&T customer to make or receive wireless calls.

An example of the way price changes can affect the market has been seen in the development of the telecommunications market in Germany in the last few months. The prices for long-distance telephone service declined by 40 percent over a period of one year (after the formal introduction of competition on January 1, 1998) and the incumbent Deutsche Telekom lost market share in about the same proportion, as resellers took advantage of the favorable (to them) interconnection fees established by the German regulator.

The prospect of voice service over the Internet could drastically change the market – as companies offer free voice service as part of a service package. Such an offer would undoubtedly have severe effects on the tariff structure and demand behavior, by encouraging large businesses, for example, to select their telecommunications service providers on the basis of the quality and capabilities of their data services, with voice „thrown in“ as a „free“ extra. Data, which has traditionally been a „poor cousin“ among the departments of traditional telecommunications operators, would then become the core business.

### **Technology Dynamics**

Technology is and will remain one of the driving forces of change in the telecommunications industry. The technological convergence of microelectronics, the computer industry, and telecommunications combines Moore's Law – which states that the performance of a computer chip doubles every 18 months – with the explosion of transmission capacity in telecommunications and the efficiency of packet-switching services. As a consequence of this conversion, the last 12 months have brought more change in telecommunications technologies than the previous 2 decades.

There is no doubt that telecommunications is moving very rapidly toward packet-switching technologies, which run on the basis of either Internet protocols (IP) or the Asynchronous Transfer Mode (ATM) protocol or both. The telecommunications industry, led by Bellcore (now Telcordia Technologies) and France Telecom, first proposed the ATM protocol in 1987. The goal was to develop a follow-on technology for digital circuit-switching that was capable of efficiently integrating a mix of services, ranging from voice to data to video, over a common switching and transmission network. The resulting ATM protocol borrows from both circuit switching and packet switching. Under this protocol, „bundles“ of information traveling on the system are fixed in size (53 bytes), like circuit-switching time slots, but each bundle has a header, like other packet protocols, to uniquely define the packet and its destination.

The change to packet switching will alter the entire industry. It will herald a fundamental change from an industry focused on the transmission of voice to one focused on the transmission of data. This will have tremendous consequences for the network infrastructure, as well as the competencies participants will need. It may also spell dramatic changes in the control of the network infrastructure.

In this context, some observers speak of the „rise of the stupid network.“ Today's telecommunications network architecture is based on architecture paradigms from more than 20 years ago. Back then, in the era of the mainframe computer, intelligence was expensive and had to be maintained centrally as a sort of shared facility

on the switching level. Nowadays, the enormous improvements in the performance of microprocessors allow for cost-efficient opportunities to let network intelligence and service functionality migrate to the end-user's desktop unit. This development will have tremendous effects on the ways services are brought to customers. More important, it will alter who controls the services and profits from them.

The centralization of services in switches and intelligent network elements provides a service monopoly for current operators of fixed-wire networks. This is very different from data communications, where many value-added services are provided in servers at Internet Service Provider (ISP) sites and in personal computers at customer premises. We expect the emerging dominance of data, together with changing industry economics, to prompt the development of a data-style service model for voice, favoring companies that currently have strong positions in personal computers and server software. As a consequence, network operators are likely to face competition for so-called vertical features (conferencing, call waiting, etc.) from similar services resident in customer premises equipment.

What will shake up traditional industry players even more is the entry of computer and software companies into the market to attract a great deal of the broadband Internet traffic. This will have two significant consequences:

- An enormous acceleration in product development cycles, similar to that in the computer industry
- A dominance in application development by the software and PC companies

The Internet as an open-development platform represents a completely new experience for most telecommunications companies, which risk losing control of the most important service developments – as well as their customers.

At the same time, the industry is seeing a significant shift in the revenue potential of various stages in the value chain. Some analysts forecast that 45 percent of value added in telecommunications in the future will go to content providers, 45 percent to those who have the customers and send them the bills, and only 10 percent to the infrastructure providers. This is of course based on the assumption that, like wireless services in Europe, services for the fixed-wire network will develop as separate businesses from infrastructure. It is also based on the assumption that the free and vigorous competition desired by regulators will develop for fixed-wire networks, just as it has for the mobile market. This scenario is a highly likely one, given that pioneering users, the computer and data communications industries, and media companies are generally much more entrepreneurial than today's largest telecommunications companies. Network operators could find themselves in a cutthroat, low-margin business unless they are able to generate or participate significantly in the revenue streams from these other parts of the value chain.

Technology dynamics are also changing the cost basis for individual telecommunications services. The rapid development of the Internet and the ability to offer IP voice services represents an enormous threat to line-switching voice services. In the consumer sector, cable television providers may be able to give away voice services as part of service packages.

### **Infrastructure Issues**

Two infrastructure trends will have a central influence on further development in the telecommunications industry:

- The integration of voice and data (and eventually video) on one network („all in one“)
- The effects of a substantial increase in transmission capacity in the backbone

The supply-and-demand relationship for transmission capacity will be the decisive question in the development of the carrier's carrier market – those network operators that provide physical connections and some basic transmission services to carriers – for fixed-wire connections. Network operators face the choice of building their own facilities or leasing or buying them from other carriers. Many capacity-swapping arrangements are being established as carriers try to match the large demands for capital, which rights-of-way-based transmission facilities require, with the revenues they are able to generate from end-users. The return on investment in broadband capacity and pricing will depend on the size of the imbalance between supply and demand and how long it persists.

For wireless networks, the results of broadband auctions will be an indicator as to whether there will be overcapacity or shortage of bandwidth. In the past, it was always possible to use the available bandwidth for modem and innovative services. The enormous investments and technological progress in the utilization of available transmission capacity could, however, be an indicator that this will change in the future. For fixed-wire networks, the huge increases in capacity that can be achieved with incremental investments in existing modern fiber-optic systems, thanks to DWDM (dense wave division multiplexing) technology, mean that today's shortage of transmission capacity may be overcome in the new millennium. We may face, instead, an oversupply of capacity, particularly on the backbone, the segment of the network that interconnects major switching nodes.

Bandwidth could become a commodity, which would mean long-distance network operators and infrastructure-based suppliers in the telecommunications market would have difficulties getting the expected yield from their investments in network infrastructure.

### **Capital Market Conditions**

The development of telecommunications markets and infrastructure requires enormous investments – in the face of enormous uncertainty and risks. The capital market has traditionally been very favorable toward telecommunications investment. For example, the challengers, Level 3 and Qwest (two new U.S.-based fiber-optic network operators that are expanding internationally and count on their entrepreneurial cultures, up-to-date networks, and data orientation to succeed against incumbent operators), have absorbed billions of dollars in investment, despite the fact that they have yet to produce profits. This financing constitutes a bet on the future – which could end in extraordinary growth and profitability.

The capital markets also view the incumbent telecommunications leaders as comparatively positive investments. However, the recent negative reaction of the capital markets to the proposed merger of Deutsche Telekom and Telecom Italia (which was frustrated when the Olivetti bid to win control of Telecom Italia succeeded; the bid had been the trigger for Telecom Italia to seek a „white knight“ in the form of Deutsche Telekom) suggests that investor confidence in mergers and acquisitions as an expression of a „too big to die“ strategy is weakening. Increasingly, the capital markets appear to doubt whether in the long run these mergers and acquisitions will succeed in achieving the synergies and economies of scale that provide their rationale today. The viewpoint that size is not everything in the telecommunications business of tomorrow is gaining ground; „elephant marriages“ can create insurmountable inertia.

One thing is certain – over the next few years, the analysts and controllers will play a very significant role, reflecting the enormous sums invested by the capital markets. We would not be surprised to see one or more telecommunications suppliers disappear after missing goals for long-term profitability or growth. The days when a telecommunications license was seen as a ticket to print money are clearly gone.

### **Regulatory Conditions**

Deregulation and liberalization policies in many parts of the world have already given the telecommunications industry a new face and will continue to reshape it. Questions of separating regulation policies and ownership roles, fair competition, the implementation of cost-based price formation, and policies toward foreign investors dominate the current debate. Experience shows that once the political definition phase has been completed, the implementation phase is much more complicated. Politics will continue to exercise an influential role in shaping the telecommunications industry, including regulating prices for competitive access to existing networks and telecommunications infrastructure. How will governments deal with having a competitor that's more successful than the incumbent, which is still partially government property? Industry and politics will increasingly wrestle with the question of foreign investment and antitrust regulations in connection with the consolidation of the industry. Recent examples include the concerns of the European Commission about the mergers of Deutsche Telekom and Telecom Italia (which, as noted earlier, is not going to take place for different reasons) and of Telenor and Telia, where the Commission seems to expect that various cable operations should be divested. (In general, the Commission views cable networks as a key competitive alternative to telephone-company local loops, and hence incumbent telephone companies should divest themselves of cable operations.) A notable event occurred when the U.K.-owned Cable & Wireless won the competitive Japanese carrier International Digital Communications (in which it already had a 30 percent stake), despite a counterbid by NTT. If even Japan, which has been strongly resistant to foreign control of its network operators, is willing to let this takeover occur, then truly a sea change in the telecommunications industry is under way, and global competition will intensify. We expect that the natural pressures and incentives of competition and market coverage will lead, as it has in other industries, to more cross-border alliances, mergers, and takeovers involving telecommunications operators and services providers.

### **The Competitive Landscape**

The telecommunications industry faces a fundamental alteration of its competitive landscape with the arrival of new competitors from varying fields:

- Resellers, which offer telecommunications services without having invested in infrastructure themselves
- New players, such as Qwest or Level 3, which build completely new fiber-based backbone nets
- Incumbents from other countries, which enter into strategic alliances in new markets
- Cable TV operators, which will be permitted to use their networks as the infrastructure to offer telecommunications services and interactive services
- Energy companies, which can use their power cables to carry telecommunications services (so-called powerline

communications)

Furthermore, companies in the software and computer industries are preparing to enter the telecommunications market at the application level and take customers away from the telecommunications service providers. Applications such as e-commerce and Customer Care – which addresses customer needs, from initiating service to responding to problems and complaints to anticipating future needs – are Trojan horses with which the information industry is attempting to position itself on the strategically important customer interface.

Naturally, this dynamic change in the competitive landscape enhances competitive behavior among telecommunications participants. Although it is difficult to predict which of the business and competitive models will be successful in the telecommunications industry of tomorrow, clearly any successful company in this field must maintain a great degree of operational flexibility. The decisive success factor will be how much the company can differentiate itself through effective marketing and leading-edge customer management. A competitive cost position and modern support system, both for network operation and for the most important business processes, are basic requirements for staying in business; they will no longer convey lasting competitive advantage. We believe network operators will therefore have to choose among several distinct strategic alternatives, just as firms in other very competitive industries have done. Some (illustrative, not necessarily exhaustive) examples of strategic options are:

- Low-cost, high-volume circuit provider (similar to a high-volume retailer, with small margins but a leading market share and lowest overall costs)
- Full-service provider, concentrating on the business market, with operations that may cover a broad part of the value chain, from infrastructure to network integration and outsourcing
- Niche service provider, with minimal network infrastructure, that succeeds on the basis of tailored offerings to specific customer sets (e.g., high-value residential customers, small businesses in well-defined geographies, or ethnic groups)
- Regional service provider, building a broad, powerful market position within a significant region, such as the European Union or Latin America
- Global services provider, concentrating on global customers

The success factors for these different strategic directions are distinct, although a single firm may pursue more than one of them. They demonstrate that there are several paths to survival and success in the increasingly competitive telecommunications services market, and that choices have to be made, since no firm can realistically succeed at all of them. One of the more intriguing aspects of how the competitive scenario will unfold arises from the changing (and uncertain) boundaries between fixed and mobile operators, as discussed below.

On the one hand, mobile access is becoming the principal access mode for telephony (by numbers of terminals and eventually perhaps even by volume of traffic). On the other hand, mobile access is still clearly inferior to fixed access for high-speed data traffic, which (as discussed earlier) will become increasingly central to telecommunications traffic as a whole. So far, mobile operators have shown themselves even less interested (and less experienced) in the data business than their traditional fixed-network counterparts. They have had little reason to pursue the data world while the name of their game was capturing voice subscribers. Some of the more interesting questions of the next decade will concern the decisions of mobile operators to enter the data world in a big way, and of fixed-network operators to combine their typically separate fixed and mobile operations to offer „seamless“ sets of data and voice services over both fixed and mobile access links. (Fixed-network operators might also decide to acquire mobile operations, as in the case of MCI WorldCom, which is conspicuous by its lack – apart from some minor resale – of mobile service offerings, in contrast to AT&T, Sprint, and major telephone operators in Europe and elsewhere.)

Eventually, the distinction between mobile specialists and fixed-network operators should blur. But which participants emerge as winners from this change will depend on the initiatives that the various participants have not yet begun.

### Scenarios for the Future

In view of the revolutionary change under way across the telecommunications industry landscape, we have developed two scenarios for the industry's potential development in the near term:

**Fixed/Mobile Divergence.** In this scenario, the fixed network serves as an infrastructure basis for high-speed, high-volume data communication. Narrow-band communication (under 128 kilobytes per second), especially at the personal level, will be conducted via cellular infrastructure. This scenario does not assume a global rollout of UMTS (Universal Mobile Telecommunications Service, which provides next-generation, broadband mobile communications), but is based on the evolution and further improvement of the existing GSM (Global System for Mobile Telecommunications, which is the leading digital mobile standard outside the Americas)

infrastructure. In this scenario, the fixed network serves as a high-speed wideband access system, especially for commercial applications.

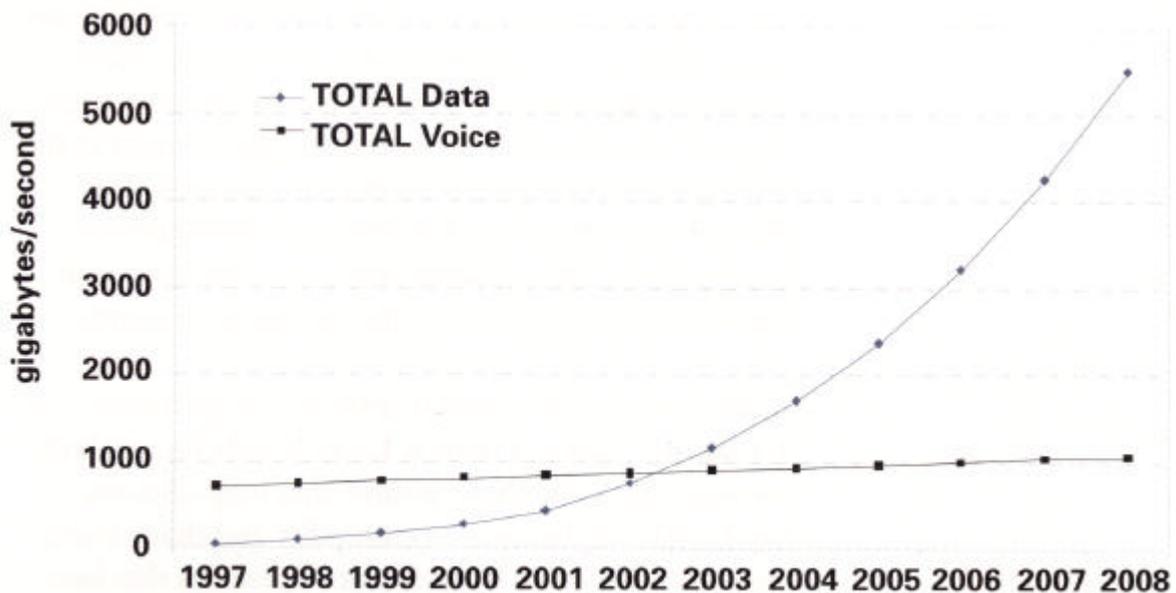
**Mobility rules.** In this scenario, UMTS or a comparable powerful cellular technology has been developed into a worldwide infrastructure that is providing ubiquitous broadband network access, enabling the user to go online anytime and anyplace. The user connects to this infrastructure via handheld communications equipment that is significantly superior to what we now know as the personal communicator. Cellular technology handles not only narrow-band communication traffic, but a large share of the broadband data traffic as well.

For network operators and service providers, both scenarios imply that mobile and data services will no longer be regarded as merely extensions of the core business, but will in fact become the core business of the future. There is consensus that although communication is dominated by voice today, sooner or later the volume of data communication will overtake it. While data traffic doubles at intervals of between 4 and 7 months, voice traffic grows 5 percent annually at best. We estimate that if data flow continues to grow at present rates, it will become the dominant traffic by 2003. Even more startling, voice could fall to about 15 percent of overall traffic by 2008 (Exhibit 1). Since mobile networks will carry a large percentage of future voice traffic, it is likely that the fixed network will carry data almost entirely and possibly video. As the enormous growth rates in data communication have their origin in applications and services, especially those that require high information capacities and bandwidths, demand for this bandwidth will initially come from businesses and only later from consumers.

In the business-customer market segment, demand will be driven by applications such as remote access to corporate local-area networks, telecommuting, online marketing, digital catalogs, email, videomail, electronic transaction systems, and videoconferencing. E-commerce will also grow quickly in the business-to-business segment and create demand for greater bandwidth from, for example, 3-D images in catalogs. In addition, the launching of IP-based end units, such as Web-TV, will drive more new applications. Videophones and video streaming may trigger greater demand. Furthermore, we foresee enormous growth for machine-to-machine communication. The dynamic of outsourcing business functions, which are not part of the core competencies of a company, is another force driving growth.

#### Exhibit 1

##### Expected Increases in Data and Voice Traffic



Source: ADL model output. Traffic includes air, land, and sea.

Growth in the consumer market segment is currently hobbled by the unavailability of broadband access. However, this could change. In the United States we have seen the enormous investments made by AT&T to acquire cable television operators TCI and MediaOne. These investments are expected to enable AT&T to provide a broadband access service via cable modems that is capable of supporting up to 10 megabytes/second from the cable TV head-end to the customer. This would be more than 1,000 times faster than the best modem connections available today and would allow AT&T and its partners, including Microsoft, to deliver interactive

entertainment services together with voice. The incumbent telephone companies, not to be outdone, have begun an aggressive program to market Asymmetrical Digital Subscriber line services that support many of the broadband access capabilities of cable modems. It is likely that over the next five years the availability of bandwidth in the consumer segment could approach the levels currently seen in the business community.

In the context of the market entry of new providers such as Global Crossing, Hermes, Level 3, and Oxygen, both scenarios outlined above assume that long-distance bandwidth will become a commodity and that we will see consolidation of long-distance operators that base their businesses solely on the marketing of network infrastructure and capacities.

Both scenarios assume that the problem of the last mile of network access for private households and business customers will be resolved cost-effectively. The question of how this bottleneck is overcome defines the difference between these two scenarios. The difference will be whether customers receive broadband access primarily through fixed infrastructure, such as XDSL or cable modems, or through cellular technologies using base stations that are bound into a dense mobile communications network.

In either scenario, incumbent telephone operators will have considerable problems finding their way around an IP-based, data-dominated business telecommunications world with a great deal of cellular traffic. The incumbents have operated in a world dominated by line switching. They are inexperienced in serving customers who want more than simple voice services. And they earn 90 percent of their revenues from voice and fax services. The ability to make the massive changes necessary to get 90 percent of income from data communication – at prices that may fall to a tenth of those today – will separate the survivors from those who fall by the wayside.

Furthermore, as data services become the core business, providers will require completely different marketing and customer-care concepts, which will need to be highly responsive and aimed at the application level. In general, the incumbents have had difficulty with such a marketing approach.

We assume that the telecommunications world of tomorrow will spawn new business models, making it especially difficult for the incumbents. We expect new suppliers to appear that specialize in serving the needs of various customer segments. These suppliers will offer new solutions that include telecommunications services, information technology platforms, software components, and operational support. Often these suppliers will originate from mergers or partnerships whose rationale lies in bundling the different core competencies necessary to develop and market industry-oriented application solutions. These new suppliers and new business models will be based on the recognition of critical user expectations (thresholds). At a minimum, users – whether they be office workers, telecommuters, or mobile users – will demand the ability to be online constantly, guaranteed network access, reliability, and a consistent environment. Value-added networks, consisting of a modem network infrastructure and value-added services, will be the necessary product differentiation of the future.

MCI WorldCom is an example of the new species of „commcos.“ This company has developed from a discount long-distance carrier into a single-source provider of practically every type of communication, ranging from local voice service to long-distance voice and data services to Web services and virtual private networks to value-added services such as e-commerce.

Traditionally, the incumbents rarely looked beyond the edges of their own plates to see where the really fundamental changes in telecommunications were taking place and how these changes might affect them. In a world in which money will be made from convergent communications services based on bandwidth as a commodity, telecommunications as we know it is dead. We are on the way toward a communications industry that will obey different laws. In this world the winners will be those that do not fear change, but treat it as a strategic weapon. Their strategic focus will be on adding value where business in the future will be concentrated – not where it is today. This means achieving a much deeper understanding of customers' requirements.

James Crowe, CEO of Level 3, was asked how he would persuade the existing telcos to help provide these new services. His answer was prophetic: „In my view, we won't. What I am talking about is a major economic discontinuity. When you go to an IP network, you get on a price/performance curve that looks a lot like computing, not like telecommunications. When that kind of dynamic occurs in other industries, the dominant providers rarely, if ever, make the jump over the discontinuity and create value in the future.“

Taken to its logical conclusions, this quote means good-bye to the old telecoms and welcome to the era of a brand-new communications industry.

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