From Internet to Superhighway: The Future of Interactive Services

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The Concept of Superhighways

Superhighways should be seen as a concept, rather than as a technology. This first became widely recognized during the United States' presidential elections in 1992. Al Gore used the concept to promote economic growth and referred to an earlier era when economic stimulus resulted from the building of the interstate (road) highway network. After the elections, Vice President Gore incorporated the concept in the National Information Infrastructure Initiative (NILL). The idea was to encourage private companies—notably the telephone and cable TV companies—to invest in this new infrastructure.

While there is a lot of talk about superhighways and even several trials and pilots, there are currently no commercial superhighways in operation anywhere in the world.

The superhighway concept is that of an integrated, broadband-network infrastructure delivering a wide range of digital, fully interactive, multimedia (i.e., voice, video, and all other data) services directly to homes, workplaces, institutions, and public places (See *Figure 1*).

The definitive factors are:

- *broadband*—widely available, reliable, high quality, and wide-ranging services catering to all possible tastes, providing lots of scope for individual choice
- *interactivity*—full, two-way interactivity means that services will be available on demand; individuals may tailor the services and contents to their own liking and provide feedback to service providers
- *digital*—in order to provide the capacity that the above elements demand, the network must be digital

The underlying technology to be built is fiber-optic cable, although recent developments in digital compression and in coaxial cable may provide enough bandwidth in the short term. Other technologies are also coming to the forefront. It can be seen then, that while several of the current—often hybrid—networks, some of which are mistakenly referred to as superhighways, meet a few of these criteria, none meet all. The Internet, for example, is an on-line, narrowband service; cable TV is based on forty-year-old analogue technology. However, both can be seen as ramps to the superhighways.

The Internet over telephone networks (28.8 kbps and 64 kbps) will dominate the market in 1998. From that period onwards, coax cable and fiber-optic cable networks are going to make an impact that will become more noticable around the year 2000. After that, growth of true superhighways will be based on fiber-optic backbone networks and asynchronous transfer mode (ATM) switching technologies.

Vision of the Future

The annual outlook for the telecommunications industry produced by the University of Southern California indicates that

FIGURE 1
Key Elements of Superhighways

- no mass deployment of superhighways until 2000-2005;
- media, not telecommunication, driven;
- not one infrastructure, but a range of roads and highways;
- hybrid technologies (I call them superhighways ramps) to test services, markets and applications will have to be built first;
- no mass media approach but niche market strategies to deliver individual products;
- hi-tech/hi-touch – clever usage of human beings);
- future offices will be more and more at home;
- more involvement from creative people, advertising, script writers, art directors, film producers.

FIGURE 2

Vision of the Future: Now–2025

Now	Now - 2000	2000-2015	2015-2025
Telephony.	Secure trading/networks.	Video-on-demand.	Fully interactive telecommu-
ISDN.	Multigagabit LAN/MAN.	Video browsing.	nications/entertainment.
E-mail.	High definition TV.	Terabit networks.	Fat panel 3D display.
Interactive voice.	User controlled networks.	Multimedia networks.	Real-time translation.
Low bit video.	Smart PCS terminals.	Speech recognition.	Personal agents.
Cellular mobile.	Deaf services.	Seamless language.	Fault tolerant networks.
	Electronic libraries.	Customised media.	

there will be a structural impact on the migration of the entire information industry towards digital electronics:

- the industry will reorient itself horizontally
- as major industry players position themselves for the future, there will be a series of within- and across-industry consolidations based on a chosen functional specialization
- the transformation will result in only three major industries, which suggests that it is going to become more efficient in the process; the three industries will be providers of digitized content, multimedia devices, and convergent networks

Therefore, companies that thrive in the future will have a bias toward personal rather than institutional markets; greater expertise and experience with digital electronics; a functional edge, i.e., outstanding expertise in performing one or more information functions; and more experience with video-based information-—technologically, other forms of information are a subset of video (see *Figure 2*).

In addition to the functional basis, three key factors characterize the evolution of the information industry in coming years each new industry will be multimedia in nature, given the convergent nature of digital electronics; each of the sectors will be global; and the industry will become increasingly driven by a model in which personal markets rather than institutional markets will become the lead markets for technology deployment.

Of the three primary sectors of the new information industry, the content area has advanced furthest towards the new model. First, a great deal of content is already digitized and ready to be used in multiple ways. Second, the rationalization of content businesses has been underway for some time, so that we already have large content entities in the United States such as Time Warner (which may soon add TBS) and the Viacom-Paramount-Blockbuster combination.

International Superhighways Market Statistics

Technological trends are bringing the telecommunications and the broadcasting sectors closer together. In particular, on digital networks it is irrelevant to distinguish between transmission of images from voice, data or text. Consequently, public telephone operators are considering entering the market for two-way video transmission (e.g., video conferencing, video telephony, video on demand) as a way of exploiting the full capacity of the new generation of broadband fiber-based networks. For their part, cable TV companies are looking to provide higher value services—such as homeshopping, electronic information services, pay per view, and perhaps even telephony—as a way of gaining new revenue sources from their existing subscriber base. Inevitably, these trends are bringing the two sectors into competition with each other. Cable TV and direct-to-home (DTH) satellite services reach over 220 million households. Roughly one-third of these are installed in North America and Europe and 25 percent are in Asia (see *Table 1*).

Some of the world's biggest cable TV markets are in nonOECD countries. The second largest market in the world in 1995 was in China, which had around 35 million subscribers. India had 16 million subscribers, a market larger in size to that of Japan. Other large Asian markets include Korea, with more than 2.5 million and Taiwan, with 3.6 million. Two other countries are also worthy of mention—Argentina had 4.5 million subscribers in 1995 and Poland boasted 2.7 million cable subscribers.

Poland's satellite TV market is also quite significant. With around 1.8 million subscribers, it was the fifth largest satellite market in the world. Hungary also has a sizeable market—900,000 satellite and 1.3 million thousand cable TV subscribers in 1995. Still, in Eastern Europe, the Czech Republic had around 650,000 thousand satellite receivers. In Asia, sizable satellite markets are to be found in Indonesia and India both around 1 million in 1995.

Markets for Superhighways

Global Overview

The U.S. broadcasting market is currently as big as Europe and Japan together, although these two zones are displaying greater dynamism. Overall, the audiovisual sector is continuing its trend away from direct financing through advertising and license fees and towards direct financing by the consumer (see *Table 2*). This largely explains the priority the major groups are according to penetrating pay TV markets and the increasing importance of distribution in the audiovisual field.

The top world audiovisual companies (see *Table 3*) are showing a certain degree of stability, even if their cumulated turnover is rising rapidly (15.8 percent), the result of market

TABLE 1

Top Cable and Satellite TV Markets (Ranked by Size) in OECD Countries, 1995

Country	No. of cable subscribers (millions)		No. of satellite receivers (millions)
	1995	1994	1995
USA	62.96	60.5	3.8
Germany	15.81	14.6	9.5
Japan	12.30	10.4	5.9
Netherlands	5.70	5.8	0.3
UK	1.42	0.92	3.4
Belgium	3.63	3.6	0.25
Switzerland	2.40	2.3	0.2
France	1.50	1.6	1.1
Sweden	1.90	1.9	0.7
Mexico	1.14	2.0	
Austria	1.04	1.03	0.98
Finland	0.83	0.8	0.15

(Source: Paul Budde Communication based on data from ITU, OECD, Siemens 1997)

TABLE 2

Service Providers' Revenues Received from Interactive TV Subscribers and Services, 1995–2004 (US $ Million)

	1995	1998	2001	2004
Europe				
Basic subscriptions	3	373	2,600	7,310
Additional services	1	168	1,100	2,960
Advertising	1	181	1,210	3,350
Traffic	0	22	176	513
Total Europe	**6**	**744**	**5,100**	**14,100**
United States				
Basic subscriptions	6	290	2,590	8,960
Additional services	3	170	1,1440	4,690
Advertising	4	220	1,960	6,790
Traffic	0	21	188	647
Total USA	**14**	**701**	**6,170**	**21,100**
Asia/Pacific				
Basic subscriptions	0	30	274	1,020
Additional services	0	14	121	426
Advertising	0	16	152	565
Traffic	0	5	47	149
Total Asia/Pacific	**1**	**65**	**594**	**2,160**
All regions				
Basic subscriptions	9	693	5,470	17,300
Additional services	5	352	2,670	8,080
Advertising	6	417	3,320	10,700
Traffic	1	49	411	1,310
TOTAL	**20**	**1,510**	**11,900**	**37,400**

(Source: Paul Budde Communication based on data from Ovum)

TABLE 3

The Top 10 Audiovisual Companies Worldwide, 1995

Rank 1995	Company	Country	Total turnover 1995 - US$bil.	Audiovisual turnover 1995 - US$bil.	Audiovisual turnover 1994 - US$bil.	Variation AV to 1995/1995	Rank 1994
1	Time Warner	USA	17,696	13,770	12,495	15.3%	1
2	Viacom	USA	11,688	9,172	5,242	75.0%	7
3	Sony	Japan	47,619	8,618	7,815	7.0%	2
4	Tele-Communications	USA	6,851	6,851	4,396	38.8%	8
5	ARD	Germany	6,531	6531	5,650	0.2%	5
6	NHK (1)	Japan	6,043	6,043	5,744	2.1%	4
7	Walt Disney	USA	12,112	6,004	4,793	25.2%	9
8	Capital Cities/ABC	USA	6,679	5,728	5,277	8.5%	6
9	PolyGram	Netherlands	5,479	5,479	4,725	2.3%	10
10	Bertelsmann	Japan	15,029	5,127	n/a	8.4%	15

(Source: Paul Budde Communication based on data from IDATE France)

growth as well as concentra-tion of players. Viacom, after merging with Paramount and Blockbuster, has taken its place with Time Warner, Sony, MCA, NHK, ARD, and Capital/Cities among the companies with an audio-visual turn-over exceeding US$5 billion.

Other significant increases are those achieved by BSkyB, MAI, Granada, and Carlton, which testify to the dynamism and concentration present in the British audiovisual sector, and by the German Pro7 private TV company that boasted a 39 percent growth in turnover. Conversely, Nintendo, Sega and RTVE are among those that have recorded a net decrease in performance.

On the world scene, it is to be noted that European and American companies are of roughly equal market importance—even though they differ radically in nature. Germany dominates in Europe (accounting for 37 percent of the turnover of European companies among the top 100), followed by the United Kingdom with 22 percent, while France occupies a relatively modest place with 11 percent.

The major companies have admittedly recorded higher growth rates, but the same cannot be said for their profitability. The average rate of the top 100 companies is in fact only around 3.9 percent of turnover, compared with 4.3 percent the previous year. Those with the highest profitability include TBL (Hong Kong), BSkyB (UK), M6 (France), and News Corp (Australia).

The Ramps to the Superhighway

The ramps to the superhighways consist of current telephone, computer, and TV infrastructures.

While still in its early stages, the Internet is currently the most important development in the superhighway market. While the concept of the service has been around for over twenty years (on-line, videotex, teletext, EDI, etc.) it was not until the mid-90's that a breakthrough occurred in this market. The major reason for this was that the PC market had reached sufficient mass to move away from being a niche market to becoming a mass market.

In 1996, the home-computer market was larger than the business PC market (see *Table 4*). The global PC market is growing at a rate of around 15 percent per year.

Current Internet, cable TV, and other networks will, over time, be upgraded and replaced with superhighway networks such as full services networks (FSN). *Tables 5* and *6*, which provide statistics on the current infrastructures, give an indication of where things might be going.

Several countries have made commitments regarding their superhighways and they claim that these infrastructures are under construction (see *Figure 3*).

To even come close to delivering on these promises, a range of issues will need to be solved, including:

- current high costs of delivery, based on current or proposed network infrastructures;
- national and international interconnect fees, which are hampering competition;
- vested interests in markets that will have to converge are stalling progress; and
- lack of procompetitive regulatory environment nationally, World Trade Organization (WTO), Organization for

TABLE 4

Homes with Personal Computers

Country	Penetration/homes
China	7%
India	9%
Malaysia	20%
Japan	21%
France	22%
UK	25%
Germany	30%
Singapore	32%
Hong Kong	32%
Australia	35%
United States	39%

(Source: Paul Budde Communication based on data from Link Resources)

TABLE 5

Vehicles of the Global Information Highway

Television sets	59%
Telephone lines	32%
PCs	9%
Total global installation base	**2 billion units**

(Source: Paul Budde Communication based on data from ITU)

Economic Cooperation and Development (QECD), and General Agree-ment on Tariffs and Trade (GATT).

In short, the global superhighway will evolve along the lines of evolution, not revolution (see *Table 6*).

In 1994, we witnessed telecommunication carriers around the world frantically jumping on the superhighway bandwagon. Global media and telecommunication joint ventures were happening everywhere. The trend, fuelled by the mega-merger negotiations in the United States, spilled over into Europe and Australia where mergers were formed, many of which subsequently collapsed.

The telecommunication and communications industry generated 6 percent of the world's trading revenue in 1995.

Now, in 1997, the mega players still do not have a clear vision of where they are going. The same is true for government regulators and policy makers, investors, developers and just about everyone else involved. All of this demonstrates that driving on the superhighways is not easy and nerves of steel, lots of stamina and sharp vision are essential. There is no doubt that the rewards for the winners will be high, but there is little room for the faint hearted.

The key issues in this field are delivery technologies (availability of the new technologies, their often unknown commer-

TABLE 6

Top 20 Plus Countries Most Likely to Take a Lead in Superhighways

Multimedia access: main telephone lines, TV sets and PCs per 100 inhabitants / major economies in 1995			
Economy	**Phone density**	**TV density**	**PC density**
United States	62.6	78	32.8
Denmark	61.3	54	27.1
Canada	59.0	65	19.3
Sweden	68.1	48	19.3
Australia	*51.0*	*64*	*27.6*
France	55.8	58	13.4
Switzerland	61.3	46	34.8
Netherlands	52.5	50	20.1
Germany	49.4	55	16.5
Japan	48.7	62	15.3
UK	50.2	61	18.6
Austria	46.6	50	12.4
Belgium	45.8	46	13.8
Singapore	47.9	36	17.2
Hong Kong	53.0	36	11.6
Italy	43.4	44	8.4
Spain	38.5	49	8.2
Korea (Rep)	41.5	32	12.1
Taiwan	43.1	32	8.3
Hungary	18.5	44	3.9
Malaysia	16.6	23	4.0
Thailand	5.9	23	1.5
China	3.4	25	0.2
Philippines	2.1	13	1.1
Indonesia	1.7	15	0.4
India	1.3	6	0.1
Average high income	**53.2**	**61**	**20.5**
Average upper middle income	**14.5**	**26**	**3.3**
Average lower middle income	**9.1**	**20**	**1.1**
World average	**12.14**	**23**	**4.2**

(Source: Paul Budde Communication based on data from ITU)

FIGURE 3

Superhighways Under Construction

Australia	passing 7 million homes by 1997
Canada	all research and educational communities connected by 1999
Europe	open infrastructure by 1998
Japan	100% coverage by 2015
Singapore	fibre to the kerb by 1997
South Korea	fibre to all major cities and offices by 1997
United States	all schools, libraries, hospitals, etc connected by 2000

FIGURE 4

Superhighway Principles

- free access to information necessary for full participation in a democratic society;
- guaranteed freedom of speech for network users, protection of copyright for creators and the right of library patrons to use material;
- a vital civic sector component analogous to an "electronic commons" for public discussion and debate;
- a healthy marketplace of ideas that is accessible to all and not controlled by telecommunications carriers;
- a set of policies that protect the privacy of the users;
- a chance for the public to be fully involved in making policies related to the network.

cial potential and life-cycles); services and content (what will people want, need and buy?); and regulatory and social policy issues (see *Figure 4*).

Carol Weinbaus, Research Director of the University of Florida, United States, highlighted the following issues that the public policy debate needs to move on:-

- What are the rules by which multiple providers will be allowed to build broadband networks to serve customers?
- What are the public policy objectives for information superhighways? Will the networks be driven by customers or by new government policies for universal service? Will this involve subsidies? If so, what will they look like?
- How will the multiple networks interconnect to provide customers with services that are easy and inexpensive to use? What will be the interconnection standards?
- What should be the structure for intercompany payments to facilitate advanced networks and services?
- What is the appropriate regulatory model for multivendor digital networks?

Infrastructure Developments

Still a Long Way to Go

Superhighways are still more of a concept than a definition. Introduced in the United States as a National Infrastructure Plan, information highways can be generally described as high-speed communication infrastructures capable of delivering all types of information anywhere by means of friendly and possibly cheap interface, as shown in *Figure 5*. The U.S. Government's initiative was followed by Singapore, Australia, Japan, and France. By 1997, many other countries had launched similar plans. Most countries are—in one way or another—addressing information highway issues. If not on a superhighway level, at least Internet highways are being explored (see *Figure 6*).

Internet and ISDN: The Runner-Ups

A key driver behind the current global interest in superhighways is the success of the Internet. Especially as electronic trading on the Internet is secured and facilitated by appropriate financial and administrative service. The effects of the Internet will be felt far beyond e-mail and on-line services, it has the potential to change the total telecommunications infrastructure, whereby the carriers and operators are no longer the central players, but where the customers are in control. The Internet has the possibility to overtake the telephone and cable TV market in size within the next five years. For this rea-son, the more advanced telecommunication broadband networks are put on the backburner, in favor of high-speed data networks that can be installed more quickly. Too little, too late, ISDN is trying to take a leading role in this, finally, after more than twenty years, finding a market for its technology.

While the developments in technology might be mind boggling, the greatest effects of the new developments will be in intellectual property rights, remote electronic trading and financial services (e-cash), taxation issues, etc. Very few countries, companies, and societies are ready for the dramatic changes that are about to occur.

FIGURE 5

Key Elements of the Superhighway Infrastructure

- Speed offered by increasingly available bandwidth, new transmission techniques and the use of optical fibres
- Intelligent networks that are simpler and easier to manage and that can be used flexibly, dynamically and in a customised fashion
- Ubiquity and mobility of end user systems that is likely to come from miniaturisation and wireless communication

FIGURE 6

Key Superhighway Techniques

ISDN	Integrated Services Digital Network integration of voice and data services
B-ISDN	Broadband Integrated Services Digital Network standardised wide range of sophisticated broadband services
SDH	Synchronous Digital Hierarchy Transmission technology to 'police' digital flow of information
ATM	Asynchronous Transfer Mode The switching technology to allocate speeds and channel mix
Frame relay	Switching technology to improve current data services
MANs	Metropolitan Area Networks Networks that can be used in some ten square kilometres
FDDI	Fibre Distributed Data Interface High speed data transmission in LANs (Local Area Networks)
ADSL	Asymmetrical Digital Subscriber Line Interactive TV on traditional networks

(NB. These technologies are all described in more detail in the Information Technology Management Report and information modules)

(Source: Information Technology Management Report 1997, Paul Budde Communication)

Apart from the increase in speed needed to deliver the new services, intelligence will need to be added to the network. A range of new services will have to be delivered to different people in different formats. The early driver of intelligent networks (INs) has been freephone, followed by virtual private networks (VPN) and calling cards. Other IN applications include premium rate services, televoting, and personal numbering (see *Figure 7*).

Commitment Needed from the Carriers

Currently, the biggest problem with the Internet is lack of bandwidth, leading to extremely low transmission speeds. Even with the top of the current range modems and high-quality Internet servers at the systems level, the speed is too slow. Many first-time users are so put off by this that using the In-ternet becomes a one-time experience.

The only thing that can save the Internet is higher speeds. At the moment there is no way that telephone systems will be able to offer this. Solutions available within an acceptable period of time are cable modems and satellite TV modems; however, a new generation of ADSL modems might offer a solution for the telephone network operators. What is needed is at least a ten-fold increase in speed.

However, the technology is not so much the problem, nor is consumer acceptance. The question is, are carriers and service providers prepared to commit themselves to the technology? The lesson learned from ISDN is that a half-hearted approach is not going to work. If carriers and service providers are serious about ADSL, they will have to put the resources into it. Realistic planning and pricing are essential ingredients in such a plan as well. Telecommunication companies have failed to penetrate the market with their alternative, ISDN services. While this technology has been around for twenty years, they have kept prices artificially high and this has stopped commercial deployment in this market. Demand for ISDN is now so high that there are not enough services available, again preventing lower prices. Current changes in the carriers' polices are too little too late. It is now up to the cable and satellite companies to fill the gap. Digital satellite TV is particularly well suited for this market, but cable TV is certainly also a big contender. With cable modem prices possibly falling under US$400, all is set for the cable TV assault on the market from 1998 onwards.

In the United States and many European markets, however, the current cable TV plants are not up to a level where they will be able to provide reliable, two-way data traffic over their networks.

While some of the cable TV networks around the world might be better placed to provide a reliable service, without a U.S. cable-modem market there may not be a sufficient mass

TABLE 7

Intelligent Network Deployment Around the Globe

Country	1	2	3	4	5	6
Australia	yes	yes	yes	yes		
Brazil	yes	yes	yes			
Canada	yes	yes	yes	yes	yes	yes
France	yes	yes	yes			
Germany	yes			yes	yes	
Hong Kong			yes			yes
Japan	yes	yes	yes	yes	yes	yes
Korea	yes	yes	yes			
New Zealand	yes	yes	yes	yes	yes	
Singapore	yes		yes	yes		
UK	yes		yes	yes	yes	
USA	yes	yes	yes	yes	yes	yes

(Source: Paul Budde Communication based on data from GPT)

to bring low-cost cable modems to the market. On the other hand, while the uptake for cable pay TV will initially be less than 20 percent, Internet over the cable might turn out to be the savior of cable TV.

Internet Set to Win First Round of Interactive Services Battle

Things are moving fast in the repositioning of the superhighways. It is becoming clearer that the digital set-top boxes and cable modems that would allow for a high-quality range of interac-tive services will be too expensive and too limited. Based on the TV concept, it is now accepted by most operators that it will be impossible in the short-to-middle term to turn interactive TV into a prof-itable operation.

At the same time, the Internet is moving so fast that it is quite possible for it to deliver the sort of interactive services that it was envisaged set-top boxes would deliver over cable TV networks. By 2001, the Internet network will be the same size as the current telephone network.

The TV and the PC are used in totally different ways, and it would be a very difficult marketing exercise to get people to use the TV for the higher level of interactive services (banking, shopping, education, information services, etc.). The TV is an entertainment box and only a low level of interactivity such as playing along with games, polling, and quizzes will be salable. A lot of such services can be financed through advertising and through pay-as-you-go charges via premium call services. You do not need a digital set-top box for this, the new enabling technology here is an advanced analogue set-tops. This equipment is more affordable, and it can be implemented in hybrid solutions.

What this all means is one development for cable TV and a different one for interactive services. It becomes clear that broadcasting technology will not be used for full interaction. This technology has missed the boat by not leap-frogging into the computer era at a much earlier stage. The race is now on for broadcasters to make the Internet available over their cable TV networks to the large num-ber of PCs in the homes. This can be done through cable modems. Price indications are already under the US$500 mark and still dropping. Because it is a computer application, it will be much easier to charge for this equipment as well as for the services.

This change in user equipment direction will, of course, also have great implications for network development. The hybrid / fiber coax (HFC) network is seen as the clear winner for broadband to the homes. New synchronous digital hierarchy (SDH-)-based networks are the ones to go into the business market. Combinations are already in use, such as the one employed by Optus in Australia. This company is leading the world in this respect, but is encountering massive problems with commercial deployment of the technology.

FSN and Cable Modems on Hold

There is a clear feeling of a hangover in the superhighway industry around the globe. During 1994–1995, operators and suppliers promised services such as video-on-demand, fully interactive shopping, and e-trading within a few years. Despite all of this hype, we stuck to our prediction that superhighways that could provide the above sort of services would not become available on a mass-market scale before 2005–2010. Many billions of dollars later, the operators and suppliers are winding down their investments, closing down pilots and tests, and shelving newly developed products and services. Some of the biggest advocates were no less than TCI (the largest cable TV operator in the United States), publisher Time Warner, and Viacom. In 1997, TCI and Time Warner both abandoned the whole lot and declared that interactive services and television were two totally different markets, and they could not be mixed and matched.

Set-top boxes and cable TV modems were finally launched in 1997. I doubt very much if they will find a large demand. Without the appropriate services why would you need such boxes? For the next five years at least, the superhighway will be driven by the Internet on PCs, not by TVs.

For the time being, the pay TV industry has the following choices:

- Provide an up-market, wide choice (200+ channels) at a premium price, aimed at a very quality- aware and highly demanding, affluent, and well-educated market. In the United States, the digital satellite TV market has been very successful in winning over this market.

- Provide a mass offering of more of the same in sport, movies, and entertainment to mass markets at low costs (US$15-US$20 per month). These services should be aimed at less affluent, less critical markets.

Unfortunately, there is very little in between on the current delivery platforms. In the short term, this might favor cable TV and free-to-air broadcasters. In the long run, however, customers will want, and will get, more choice. There is now a better chance that Internet-based rather than TV-based developments are going to be the trendsetters for the superhighway.

Alternative Infrastructures

New privatized IT infrastructures from organizations such as banks could easily include telecommunications services in their offerings. The same applies to energy companies, water authorities, and other utility organizations. Imagine the following: you will call your bank and the Interactive Voice Response (IVR) service asks you to press one for your statement, two to transfer money, three to make a phone call, four for Internet access. Your call will be routed over their network—they have access to your bank account so there will not be a bad-debt problem. Local calls could be free to customers, special discounts apply for loyal customers, etc. Watch out for interesting alliances between banks, utilities, and other large organizations and service providers.

But, despite all of this, most spectrum auctions around the globe are doing very well indeed, and more capacity has been sold to create a whole variety of new infrastructures in the mobile communications world, with applications of which we have not yet dreamed.

Global alliances such as Global One, Unisource, and others see a great future in infrastructure and are investing heavily in it.

Insatiable Need for Bandwidth

How can we make sense out all of this? First of all, I stick to earlier statements regarding the investments made by carriers cable TV and other network structures. “Shortly, I would like a permanent open Internet connection with full broadband capacity that allows me ongoing (video) access to information and entertainment around the world, based on an intelligent software program driven from my PC that indicates what I am interested in and only provides me with the info I want at a particular point in time. Very much in the way secretaries, personal assistants, and the good old-fashioned butlers worked.” The bottom line is that, as in the past, carriers do not have to worry about demand. The software and content industry will create this demand—in a similar fashion to the PC and Internet developments.

Therefore my message to the carriers is build networks, build, build, build! Talk to any thirteen- year-old who has a PC, and check what they expect from interactive entertainment, and you will quickly be able to calculate the impact if only 20 percent of the population want to use the open broadband-based networks that would allow for the applications that people want. Increases in network capacity that are inconceivable to us now will be needed within a five to ten year period. However, only those companies highly specialized in building, maintaining, and managing such infrastructures will be able to operate in this market. There is no room for small players. Currently, small players are meddling in this market with switches, personal communication services (PCS) and other networks, but, apart from a few niche markets, none of the small infrastructure operators will survive. Most of them will have sold their hardware within a few years to the bigger players. Once competition in this market is properly established it will be far cheaper to buy from these larger players than to operate these networks themselves. On top of that, all the hassle of maintenance and upgrades in our fast-moving, tech-nology-driven market will be avoided.

Fixed Will Be Wireless, Wireless Will Be Fixed

Just when service providers (SPs) thought they would use the inexpensive PCS technology to build their own local-access capability, AT&T in the United States has indicated it is going to build a nationwide local-access system based on this technology. Last year, the company abandoned several of its vertical integration strategies in the area of value-added services. It clearly wants to be the prime infrastructure supplier in the United States. This is a clear message to all other carriers and SPs around the world: you must either be serious in the infrastructure market, or you must be a customer-focused SP. If you are not, the market will weed you out very quickly.

I do not agree with some commentators who see the AT&T move as the end of HFC networks, but as an effort to get into the local-access market. Voice communications will be transferred from fixed to mobile, and entertainment services will be moved from wireless (free-over-the-air) to cable-based networks in metropolitan areas.

In both situations, the 80/20 rule (80 percent mobile, 20 percent fixed, and the inverse for entertainment prevails).

Urgent Need for Wider Participation

The networks, however, must be open to content and service providers. Only these organizations will be able to make sure that the revenue stream starts flowing in. It will be impossible for the carriers to turn their networks into money makers. The carriers, however, must provide the best possible networks for such services, otherwise customers will use other in-frastructures to obtain the services they want.

The new concept of interworking and market specialization will be molded much like the Internet—a totally open system, dominated by no one, where everyone contrib-utes to the total success. Carriers build and upgrade the infrastructure;

service providers operate in local access, Web hosting and niche markets; content providers are developing new services; software developers are adding an amazing range of features to create a more user-friendly Internet; hardware suppliers are spurred into action with new modems, switches, security equipment, etc.; business and other organizations launch their products and services on the Internet; and banks provide the financial-transaction infrastructure needed and so on.

Services and Content

Convergence Creates New Demand for Services

The telecommunication sector is at the heart of a much larger industry—information and communication technology, or "infocommunications"—which was worth some US$1,370 billion in 1995. The convergence of the telecommunications sector with the computer and the broadcasting world is creating new synergies, most evident in the exponential growth of the Internet, which continues to double in size every year.

At the start of 1997, there were some 16 million host computers connected to the Internet and more than 50 million users. The significance of the Internet lies perhaps not so much in what it is, but what it will become. It can best be regarded as the prototype of a global information infrastructure that will lay the platform for the electronic commerce of the 21st century. Estimates of the value of transactions carried out via the Internet in 1996 ranged between US$1 billion and US$3 billion.

Services and Content: Keys to Success

While the infrastructure is of crucial importance, eventually the technology will be virtually ubiquitous. The premium, therefore, will be on content. It will be the service providers who will have to package this in such a way as to generate users' interest. Content and SPs will play a key role in making the superhighway viable for all parties involved. Made complacent by the virtual monopolistic control of their distribution systems, many of the major players have been slow to recognize that the age of mass media is about to end, replaced by a spectrum of niche markets.

Service and content providers can be divided into the following main categories (see *Figure 7*):

- Traditional full-motion-video content providers (movies, documentaries, news, sports)
- Advertising agencies and other producers of commercial video material
- Telecommunications and other interactive service providers, teleshopping, telebanking, EDI, EFTPOS, on-line, videotex
- Multimedia and software developers, currently mainly producing education and games

Other important groups, closely aligned with service providers, are content centers for digitizing and storage services, and packaging and marketing organizations.

Initially, the emphasis will be on traditional pay TV services (one-way video, movies, sport, etc.). This market is heavily dominated by the eight big studios in Hollywood. With an output of over 1,000 movies a year, the content market in India is larger than that of the United States; the Chinese market is also very large. Companies such as STAR TV (News Ltd), PBL (Kerry Packer, Australia), and MTV (Viacom) are establishing joint ventures and new alliances in these two important language and culture markets.

As the technology battles in relation to multipoint distribution systems (MDS), satellite and cable are coming to a close, the focus will now shift to content. Obtaining the rights to movies is an expensive hobby—a blockbuster costs anywhere between US$500,000 and US$700,000. With more groups com-peting for these products, prices for top products will be high and it is not difficult to get the best products but go broke before you put them on your pay TV service.

Killer Applications

There will not be one killer application that will suddenly turn mass markets on. Numerous niche market applications,

FIGURE 7

Superhighway Offerings

- enhanced analogue cable television;
- video on demand;
- video games;
- interactive video shopping;
- interactive gambling;
- distance learning;
- driver's licence renewal or tag registration;
- video conferencing;
- access to long distance telephone numbers;
- personal communication services;
- full motion video picture phone service on full sized TV screens;
- medical imaging;
- high speed data transport for businesses.

TABLE 8

Killer Applications Revenues

Killer applications	Revenues 2005 US$ billion
Information services	19
Gambling and porn	22
Advertising	34
Entertainment	55

(Source: Paul Budde Communication based on data from Ovum)

packaged in the right way, will be the way to go. The software that will allow customers to find the services and information they want will play a key role in this process. According to research information from Ovum Ltd in the United Kingdom, the major applications on the global superhighway market will be worth some US$130 billion by the year 2005 (see *Table 8*).

Cable Telephony

The first cable networks were installed in Britain between 1990 and 1992. No technical arrangements were originally made to facilitate telephony. Now, all parties involved in the British cable TV business agree that cable without telephony will never be a money maker. Telephony not only makes it possible to get a return on investment quicker than was originally anticipated, it also makes the difference between a profitable cable TV network and an average money earner.

On-line Gambling

While Australia has the dubious honor of being one of the leaders in the gambling world, other Western and Asian markets are not far behind (see *Table 9*). Regulation will be the only thing that can stop this application from becoming a killer application.

Gambling from home will take away business from casinos, hotels, and clubs. Key applications for interactive TV are horse racing, football, and other sports. Viewers will be able to place bets using a remote control, smart cards, and PIN numbers.

The gambling market will stimulate growth in the interactive market in groups aged between thirty and forty-five years. Promoters of on-line gambling argue that it will eliminate the alcohol abuse, peer pressure, and overspending that often accompany gambling in casinos and clubs.

Adult entertainment

Adult entertainment is still a very contentious issue, with heavy censorship rules in place, or on the way, in the United States, Australia, and Asia. However, conservative America is now openly presenting adult entertainment as a killer application on cable TV. After the 1980s when such services were banned wherever possible and where instead serv-ices such as homebanking and homeshopping were pitched heavily to the consumer, adult services are now back on the agenda. In the past, adult entertainment has been the driving force behind audiotex and videotex. At a certain stage, Telstra in Australia even had a joint venture running with Penthouse on their on-line service.

However, the Internet phenomenon is stirring the debate again. Rather than crucifying such services, the industry and the governments should look for proper regulation rather than prohibition. A sensible approach to such services could restrict unwanted material such as violence, sex, and child pornography and avoid usage by minors (see *Figure 8*).

Apart from this, adult entertainment could be used among other services to get people involved in the new services. This in its turn could create a viable market with more money to spend on services that yield less or no profit (education, health care, community services). All that is needed is an adult approach to adult entertainment.

Pay TV

More of the same will not entice potential users. Because of pent-up demand, however, pay TV will stimulate a high uptake of services in the first six to eighteen months in countries such as Australia and Asian countries. But unless the operators immediately switch to a large number of new services, the initial subscribers will leave these services in droves when they have to renew their subscriptions. While the issue of how many channels users really want (potentially upwards of 500) is still hotly debated, the available evidence shows that the more choice that is provided, the higher the uptake will be. For example, you would not go to a library that only holds fifty books in stock or to a newsagent that sells only their preferred newspaper and a handful of their favorite magazines. The success of special interest groups on the Internet and other on-line services, the fragmentation of the music industry over the last few years, the proliferation of specialist magazines, and the increasing interest in art-house films, are all strong indicators of the increasing emergence of niche markets. Popular culture is no longer the un-sophisticated, homogenous mass market it was in earlier years.

More and more confirmations are coming in from initial trials that have been conducted along these lines. The major reasons for the lack of success were:

TABLE 9

Gambling Statistics

Country	Gambling per head/p.a.
Australia	US$400
Hong Kong	US$370
United States	US$170

(Source: Paul Budde Communication based on data from International Gaming & Wagering Business)

- after an initial period of high usage, movies-on-demand are only used a few times a month;

- the depth and width of other services provided, such as entertainment, shopping, hobby, etc., is far too small—most information and services are already known to the user and the extra information is of little use; and

- services delivered via an analogue system are described as old-fashioned and useless as it does not even allow rewinding and pausing in video-on-demand services, features users have been used to for more than a decade on their VCR.

With the successes of CD-ROM and on-line services, a trend that will lead to sustainable growth of new interactive services will, in the short term, be based on PC-based narrowband Internet services. Over time they will grow into fully fledged broadband networks.

News Services

News, at times when you want it and about what you are interested in, has become a key element in the current cable and pay TV developments. Viewers no longer have the time and interest to make daily appointments with their broadcaster at 6pm to watch the news. In the United States, news viewing time on the major networks went down from 60 percent in 1993 to 42 percent in 1996. Local news still scores around 65 percent, but is also down, from its 77 percent high in 1993.

This is opening up the market for specialized players, providing a premium service for which viewers are prepared to pay.

Demand Side Management

Utility companies are contemplating their possible participation in the telecommunications and cable TV industry. There are compelling reasons for them to do so as they will be able to make considerable savings and, at the same time, tap into new revenue streams. Cable TV operators are already describing the energy management services as the possible killer application that will make it commercially viable to start delivering interactive services to their subscribers.

DSM is an electronic energy information system, based on telecommunication or cable TV networks, which enables customers to keep track of their household electricity use and make adjustments via an on-screen reading on their TV or PC, thus saving them money. Eventually, all of a home's appliances could be programmed at certain use levels—depending on time of day, season, and customer lifestyles.

Energy information services (EIS) include:

- Automated meter reading

- Immediate outage detection

- Real time energy usage information—customers will know how much energy they are using, allowing them to make intelligent decisions on conservation

- Real time pricing information—customers will know their current energy costs, allowing them to manage their usage or shift their activity to a different time of the day

- Customer flexibility to schedule electrical use—customers could preset lighting appliances and thermostats to control their operation

- Electronic billing and bill payment

- Energy usage detail—customers will know how the use of an appliance, like an air conditioner or pool pump, contributes to their overall energy bill

Trends favoring energy conservation and competition in power generation are constantly pushing utilities toward DSM as a way to reduce costs, minimize investment in new power plants and improve customer service. DSM can represent a saving of approximately US$400 per household. Two-way coax, used in cable TV networks, provides the level of services that utilities need, including processing power at the user end of the network, e.g., graphical user interfaces (GUIs).

It is very important for the utilities to have a broadcast-communication system. Current telecommunication systems do not provide this. Copper cable–based telecommunication networks are, for example, not able to alert the entire community to the fact that, because of certain weather patterns, the price of electricity will go up for the next three hours. Cable or radio systems are therefore better suited for utility applications.

Cable TV is a low-cost provider of communication services, plus it provides intelligence to the home to help manage the home energy system. With cable TV, there will be a separate communication path to these homes, with data going through the cable TV system and with software supporting specific energy applications in those homes.

Utilities, telecommunication companies, and cable companies have the potential to be fierce competitors in the network infrastructure market. The question is, however, is it economically viable to build three separate fiber-coax systems to each home?

In Australia, several utilities are involved in Optus's plan to use their infrastructures. However, like all other superhighway projects, DSM also is still several years away. Projects in the United States are delayed or have been abandoned. The largest trial so far involved America's largest utility company, PG&E. Microsoft was involved in this project with a software product code-named Amazone (based on cable TV networks). This development has been abandoned, and Microsoft addressed DSM in its general fiber-optic project, code-named Iceberg. Telstra is also involved in this project, but beta products are not expected for another two to three years.

This does not mean that DSM as a concept will have to wait all that time. In 1995, the U.S. and Australian energy markets were deregulated. It will not take long for entrepreneurs to enter the market and attract the utilities market with new in-

TABLE 10

Falling Videoconferencing Costs

Year	Transmission link	Equipment
1985	US$2,000	US$250,000
1995	US$20	US$1,000
2000	US$5-US$10	US$500

(Source: Paul Budde Communication based on data from ITU)

novative products and services that will take the cream off some of their most profitable markets. This trend will be very similar to what is happening in the telecommunication market at the moment.

Videoconferencing

The top end of the videoconferencing market has been growing at a compound annual rate of 48 percent, with sales of approximately US$2.7 billion projected for 1998, up from approximately US$1.1 billion in 1995. Growth in all other segments of traditional videoconferencing is stagnant and even declined slightly after 1995. After being around for over a decade, very little progress has been made so far—this despite the fact that hourly costs dropped from US$2,000 in 1985 to US$20 in 1996 (see *Table 10*).

The real interest in videoconferencing is not in the US$100,000+ systems, but in smaller scale, reasonably priced videoconferencing systems for desktop PCs and laptops, which are ideal for smaller group meetings, small business, classrooms, even for use by extended families. Videoconferencing-enabled PCs are now available for a fraction of the price usually associated with ISDN, fiber-optic, or satellite-based videoconferencing technologies. The size of the market for community-based videoconferencing systems is growing. It is becoming more user friendly than existing communication technologies and will, over time, replace most of the current systems in use. Videoconferencing is no longer the exclusive province of large corporations with significant technical and financial resources.

The growth of ISDN and the Internet is facilitating the interest in desktop videoconferencing and simultaneous voice and data transfer services for small businesses and consumers. Not as a stand-alone application, but integrated with other services, videoconferencing will be able to regain its place.

The main barrier to the market growth of mass multimedia–networking services at present lies in the high bandwidth required for high-resolution, real-time interactivity. As fiber-optic density in national networks grows, and particularly as the penetration and cost of fiber-to-the-home connections decline, demand for interactive multimedia services should expand dramatically. The diffusion of such networks will in turn depend upon the technological development of the component industries, general macroeconomic conditions affecting demand and supply, as well as the regulatory structures adopted by governments.