

Viewpoint

Hitchhiking on the Information Superhighway

David L. Fishman

There is some uncertainty about who first coined the phrase, „the information superhighway.“ U.S. Vice President Al Gore takes credit for coming up with this felicitous phrasemaking as early as 1978. In the car-crazy U.S. culture, the metaphor quickly occasioned a deluge of clever wordplay. Miles of print and emission clouds of rhetoric trumpeted metaphorical „speed limits,“ „learner’s permits,“ „jackknifed trailers,“ „rest stops,“ „emergency lanes,“ „roadkill,“ and „unlimited mileage“ – all deployed to describe variations on an event that might or might not actually take place before the end of the century. *The Wall Street Journal* even devoted a front-page article to the phenomenon of the „metaphor industry“ that had grown up around the information superhighway, and the American Dialect Society voted the phrase „Word of the Year“ for 1993. There are, of course, serious questions as to what „the information superhighway“ *really* means and whether it will in fact be built. The answers to these questions vary widely, even among my colleagues at Arthur D. Little.

This superhighway is of more than passing concern to suppliers of the products and services likely to build it or to cruise its so-to-speak lanes. And while we are focusing here only on its prospects in the United States, other nations are observing the U.S. road-building effort with keen interest. Will it turn out to be a direct route, a circuitous detour, or an axle-smashing deadend road? In this article, I propose to do three things:

- Examine the significant obstacles that stand in the way of highway completion (particularly financing)
- Look at possible ways to overcome these obstacles
- Predict my personal view of a likely future scenario

(And I promise to make a *sincere* effort to omit highway metaphors and double entendres henceforth!)

Defining the Information Superhighway

The information superhighway, as a vision of the future, is many things in the eyes of as many beholders. In general, there is agreement that the metaphor describes a convergence of the entertainment, television, broadcasting, telephone, and information service industries, powered by the digital language of the computer industry. Most envisioners anticipate that once the highway is in place, each customer will be able to receive – at the touch of a button in his or her home – the movie, other entertainment program, information service, or portion of a video shopping catalogue he or she wants *when* he or she wants it. And, of course, the customer will be able to *interact* with the material on the screen, ordering goods and services, navigating through the choices, expressing opinions (yes/no or multiple choice) on subjects of interest. The acronym most often used to describe these options is SIWWIWI – “stuff I want when I want it.”

Strictly speaking, the „highway“ is the entire system. It will include a video server at the point of origin (head end), which will store material, retrieve it, and send it out; the switching gear that will move the messages around; and the pipes that carry fiber optic cables from the head end to television units in homes. It will also include a very intelligent box on top of the television set: an expensive, multipurpose personal computer that will regulate the information coming into the home and going back out to the head end or beyond. The stream of information (audio, video, or data) will be in digital form, compressed at the head end to facilitate volume, then decompressed and converted back to an analog video signal by the computer/box on the television set.

In another sense, the information highway is really a state of mind. It is a new way to facilitate both personal electronic communication and the interchange of data. In this mode, it is a hybrid between the telephone and the mail systems: E-mail, the interactive use of electronic bulletin boards, and the emerging use of the RBDS side band in radio all qualify as part of the information highway.

But What Will It Do?

Is Ray Smith, chairman of Bell Atlantic, correct when he asserts that „we stand on the verge of a great flowering of intellectual property, a true Renaissance that will unleash the creative energies of inventors, entrepreneurs, hackers, artists, and dreamers?“ Is Bill Gates of Microsoft right when he defends the potential of the information superhighway as an enabler, permitting us to use time more effectively, whether at home or in an office, to communicate with others freely and in a nonthreatening environment on subjects of mutual interest? Even if we recognize that the much-discussed vision of 500 channels is a mythical beast, the advent of considerably more channels and choices must be considered seriously. *Or* is all this discussion simply a South Sea Bubble for the electronic age? Will the opiate quality of mass entertainment programming merely be supplemented by multiple incremental versions of the *Amy Fisher Story* under the guise of additional choice? Certainly the progress of technology can theoretically make many glittering dreams possible. But, as we are all aware, technology facilitates progress and product offerings; it *does not* motivate people to use them. And this, in my view, is

where the all-pervasive highway metaphor begins to break down – on the rocks of capital investment.

The Money Muddle

How will the information superhighway be financed? Or rather, *who* will pay for building this infrastructure? Even John Malone of Telecommunications Inc. (TCI), during the short-lived euphoria of his company's announced merger with Bell Atlantic, was clear in stating that managing the information superhighway/ network was likely to be a very low-margin business, like a supermarket where high volume makes up for low margins.

The complex and comprehensive U.S. interstate highway system was built largely with federal funds. No one has dared suggest that federal (or indeed state) funds will be made available to finance the information superhighway. Without such funding, however, the burden of payment will land squarely in the lap of the private sector. More specifically, the organizations picking up the tab will be the large cable system owners (MSOs) and the regional telephone companies (RBOCs and independents such as GTE and SNET). Under this scenario, the investors will need to recover their investment through revenues and profitability. [When the transcontinental railroads were built in the latter part of the 19th century, private sector capital was responsible; but the government of the time was extremely generous in giving away right-of-way land grants to offset the risk. And when the airline business was young and struggling, the federal government provided indirect subsidies through lucrative contracts to transport the mail.]

Both primary parties at interest, the cable companies and the telephone companies, have their own reasons to build *part* of the new networks: the fiber optic cable trunks. This portion of the total project is already underway. Fiber optic cable trunks provide more than just an enormous expansion of bandwidth capability – fiber optics can save telephone and cable companies a lot of money in maintenance/repair costs. The fiber optic trunks also give cable companies the capability to provide certain telephony and other telecommunications services – a chance to grab some of the enormous (and higher margin) revenues of local telephone companies. By the same token, the local telephone companies are in the process of refurbishing *their* local networks, replacing traditional copper wire with fiber optics in order to provide a wide variety of new telecommunications services. So at least the middle part of the highway – the fiber optic network – can be justified and will almost certainly be built.

What about the rest? Who will finance:

- The expensive electronic switching equipment?
- The video servers, which will store program material (in digitized format) in much the same way that an old-fashioned jukebox stores (and retrieves) musical material?
- The intelligent personal computers on top of each television set?

And how will they get their money back and a return on their investment?

Estimates of costs required for these parts of the infrastructure are a moving target. There is a great deal of uncertainty about the extent of savings that might be achieved through high-volume manufacturing. It seems likely, however, that the costs will be at least \$1,000 per television set (including installation)¹. Multiplying this by the number of current cable television subscribers, one arrives at a figure exceeding \$57 billion, *before* adding any noncable households or households with multiple TV sets. Estimates of projected aggregate costs for the entire infrastructure have ranged from \$15 to \$20 billion for *each* of the seven Bell operating companies (before the end of the decade) to a total cost of \$110 to \$300 billion by the year 2010.

Everyone seems to agree that entertainment (feature films, musical events, and cultural performances) plus sporting events will be a primary source of revenue for the owners of the infrastructure. But the requirement to obtain a return on investment will add significant costs to each transaction. Where the attraction is *non-exclusive* (i.e., where it can be accessed through other media such as retail video stores or pay television packages), these additional costs are likely to result in prohibitively high pricing. Moreover, for major sports events there is a political „Catch 22“: the more important and attractive the contest (the Olympics, the Super Bowl, the World Series, play-off games), the more difficult it will be for the league to take the exhibition off „free TV“ and restrict it to pay-per-view.

Home shopping and other transactional services via television are already a substantial business. That business should be enhanced by the greater convenience of on-demand scheduling and on-demand ordering capability. That is, the ability of the consumer to access subject matter he or she wants *on demand* and to order goods and services instantly (without using the telephone) will make these services more attractive. But the need to add to transactional costs in order to amortize capital spending on infrastructure (as with films) is likely to place a heavy competitive burden on prices.

Can anyone envision the volume of customer activity that will be required to recover such vast sums of capital investment? To put the number in context, it is true that total U.S. expenditures on entertainment (motion pictures, home video, cable television, video games, and recorded music) were estimated to be approximately

\$48 billion in 1993. In addition, home shopping via cable amounted to almost \$2.5 billion. But the infrastructure of the information superhighway will be a *conduit* for these activities rather than a *product substitute*. Therefore – even at a generous estimate – it is unlikely to capture more than an incremental 20 percent of the aggregate expenditure in „tolls“ to amortize against the investment cost. Even if the market grows because of enabling technology, the calculation remains relatively straightforward: 20 percent of approximately \$50 billion in revenues implies a lengthy payback period *before* any consideration is given to interest costs or the discounted value of future revenues.

I have used more sophisticated economic analysis tools to study this situation and the results are the same. The bottom line remains: there is no way to „justify“ (economically) the expenditures that will be required to build the information superhighway infrastructure on a purely rational economic basis. No conceivable combination of revenues from delivering entertainment, transactional services, or shopping via the electronic infrastructure is likely to bring in sufficient revenues to pay entirely for the costs of construction, let alone earn a decent return on the original investment.

Furthermore, there are issues of timing and waning enthusiasm. Ray Smith of Bell Atlantic proposed a number of „killer applications“ as an initial justification of the TCI acquisition agreement. In the wake of that agreement’s demise, most observers consider the applications to be „involuntary manslaughter“ at best.

Initial field trials, (already delayed) in Omaha, Nebraska; Orlando, Florida; Castro Valley, California; and Alexandria, Virginia will have begun by late 1994. Results will be available for analysis by the middle of 1995 at the earliest. If by then there are no truly significant cost breakthroughs or, on the revenue side, no discovery of truly innovative programming that will enormously enhance demand and potential profitability, we believe that the enthusiasm to build the costly infrastructure will decline precipitously.

Already we can see some of the air leaving the soufflé. No sophisticated observer believes that FCC-mandated cable rate cutbacks and ceilings are entirely – or even mainly – responsible for the collapse of the Bell Atlantic-TCI and Southwestern Bell-Cox merger agreements. Much of the responsibility for these „potholes“ comes from a declining sense of optimism about future highway-derived revenue streams.

After mid-1995, it is anyone’s guess as to how long the build-out will take. Pessimistic forecasts currently project that only 20 million U.S. homes will be hooked up to some version of the information superhighway by the year 2000. If our analysis is correct, less than half that number will be fully activated, with additional roll-out slowing dramatically.

The Government to the Rescue?

The wild card, of course, is public sector intervention in funding. In the best tradition of free market bravado, many cable and telephone industry executives have called for the government to stay as far away as possible from the information superhighway. Their theme is: government regulation is not wanted here; government financing will not be necessary. If I am correct about the end results failing to provide economic justification for private investment any time soon (and maybe never), this tune is likely to change dramatically within a few years. But in an era of enormous annual deficits, high trade imbalances, and diminishing capability to pay for basic social services, the prospects for direct federal subsidies seem minimal. Nonetheless, some type of government analog to corporate off-balance-sheet financing, perhaps in the form of government guarantees, special investment tax benefits, or accelerated depreciation, might well be politically acceptable.

Can a rational case be made to justify government financing? Historically, nations have competed in the world at least partly on the basis of infrastructure resources, such as deep harbors, excellent internal communications, good roads, and trained labor forces. The information superhighway certainly qualifies as infrastructure that could serve the economic activity of the nation. Information certainly creates significant value. While the most publicized traffic is likely to be entertainment programming, there will also inevitably be a considerable amount of public-interest programming. (From this perspective, the Internet currently represents the beginnings of the information superhighway.) Examples include the following:

Education. One way to help inner city education is to link those schools in a continuous and open educational forum with central teaching resources. Distance learning and convenient access to interactive multimedia information, education, and „edutainment“ could go a long way toward creating equivalent opportunity for under-financed schools that would otherwise be unable to attract high-tech resources.

Health Care. The same reasoning holds true for sharing of health care system resources via the wired infrastructure. Scarce medical expertise and high-cost medical machinery can be shared via communications links that will have the capability to transmit voice, video, and data.

Libraries. Public libraries in the United States are increasingly beleaguered, struggling to redefine missions and refine operating strategies in the wake of a changing social environment, diminishing (local) government funding, and increasing costs of research materials, technology, and other necessary resources. For the library

world, it has become apparent that we are in an age of sharing access to materials rather than redundant ownership by each local institution. The obvious facilitator for „sharing“ is an infrastructure of wired networks between institutions.

This is the strong positive case for public sector financing of the information highway – the need to provide significant funding to help our public school systems, to alleviate escalating health care infrastructure costs, and to provide linkages for public libraries. There is also a pressing need to ensure that the gap between information „haves“ and „have nots“ does not widen beyond its current size.

Likely Outcomes

After all the sound and fury about the information superhighway, what are the likely outcomes? Without claiming an above-average ability to foresee the future, here is what I think is likely to happen by the end of the decade:

- A substantial portion of U.S. cable subscribers, perhaps as many as 30 percent of cable households (approximately 18 million households), will be able to access 175 to 200 channels. These might include a configuration of:

- 80 channels of „conventional“ cable TV networks (entertainment and information)

- 64 channels of pay-per-view through either video on demand or near video on demand

- 30 to 50 channels for shopping, transactional services, and data retrieval

- Regional institutional networks for education, health care, and library access will share physical resources with those portions of the cable infrastructure that have been built by that time.

- Much of the construction of the cable infrastructure will have benefited financially from a hybrid combination of federal investment tax credits and accelerated depreciation allowed for this purpose.

- The frenzy among telephone companies to acquire cable system operators and entertainment companies will have abated considerably. Many of the regional telephone companies will be in the cable television system business, primarily (but not entirely) within their local telephone service regions. Some large cable system operators will be providing communications services (wireless, business-to-business data transfer, and local access to long distance), but this will not be a widespread phenomenon.

- Consolidation will continue – at a gradual pace – among cable television system owners. Driven by the need to gain access to capital, the 20 largest MSOs will acquire ever-larger regional clusters of systems.

In my view, the information superhighway will eventually be built, but it won't have as many lanes as some people imagine now. The government will have to lend a hand in its construction. And private toll collectors will come to realize that the public will only pay so much to travel on this road.

¹*Households with multiple TV sets to be connected will, of course, require multiple set-top boxes and therefore additional investment.*

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