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Although most attention to problems in the telecom industries has focussed on corporate malfeasance – e.g., Worldcom, Global Crossing, Adelphia – the largest single failure may have been in the public sector. A decade ago the United States government promised the country universal access to a high-speed two-way broadband network, capable of delivering megabits of data and/or high-quality video. The White House's National Telecommunications and Information Administration (NTIA) described this "National Information Infrastructure" (NII), or "electronic superhighway", quite explicitly as a high-bandwidth network with far more capacity than data services such as the Internet:

> People could live almost anywhere they wanted, without foregoing opportunities for useful and fulfilling employment by 'telecommuting' to their offices through an electronic highway; the best schools, teachers, and courses would be available to all students, without regard to geography, distance, resources, or disability.[1]

But with the exception of a few corporate, governmental, or academic in-house operations–"local area networks" (LANs) – nothing like the NII exists today. The Internet has not taken over the NII's role. In terms of both speed and

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[1] *Agenda For Action 3,* THE NATIONAL INFORMATION INFRASTRUCTURE, (Nat'l. Telecom. And Info. Admin., D.C.). Sept 15, 1003, at 1.

bandwidth, the Internet does not even begin to live up to NTIA's promises.[2] The reason is that government essentially ducked out on its initial promises, leaving implementation solely up to the private sector–which lacks the resources or interest to act. By doing so, the government took itself out of the equation, leaving responsibility and visibility with the private sector–which in the United States need not and does not disclose much more than its existing financial situation.[3]

The irony is that the information superhighway was designed partially to enhance "electronic democracy,"[4] but this goal has fallen into a black hole. This paper thus attempts to analyze how far the private sector has gone, and plans to go in implementing the NII.

I. THE TECHNOLOGICAL DILEMMA

A previous article[5] explored the technological problems in implementing the electronic superhighway. At present, only two media seem to have any chance of delivering NII-type bandwidth without building trillion-dollar new telecommunications networks. These are the local exchange telephone companies (LECs) – generally the large multi-state Regional Bell Operating

[2] Michael Botein, *Information Superhighway: Is it Financially Feasible?* N.Y.L.J., Sept. 16, 2002, at 7.

[3] Unlike the European practice, "freedom of information" in the United States applies only as against the federal government and only to a very limited extent. Obtaining information about even short-term strategic planning by private companies, thus is quite difficult; they need not make any planning documents–as opposed to financial reports–available to the public. Precisely for this reason, some of the most crucial information in this paper is attributed to anonymous sources.

[4] For an excellent discussion of this concept in the context of the Internet, see Beth Noveck, *Democracy's Demise? The Impact of Internet Technology on the Perception of Democratic Legitimacy,* DEMOKRATIE: MODUS UND TELOS, 47 n.3 (2001).

[5] Michael Botein, *Ten Years On the Information Superhighway,* N.Y.L.J., July 16, 2002, at 5.

Companies (RBOCs) divested from American Telephone & Telegraph Co. (ATT) in 1984[6] -- and the increasingly large cable television systems.[7]

The good news is that LECs are switched, making it possible for any telephone user to connect with any other user. The bad news is that they have extremely limited bandwidth; after all, they were designed more than a century ago for audio conversations, which require very little bandwidth – about one-thousandth as much capacity as used by real-time video. But it may be possible for LECs to deliver large amounts of data or video through use of a relatively recent upgrade – a digital subscriber line (DSL).[8] DSL still is relatively expensive, however, and a link can go only about three miles before running out of power. Extensive new equipment as well as "home-run" lines to areas beyond three miles from central offices are necessary and expensive.[9]

Conversely, cable systems with state of the art hybrid fiberoptic-coaxial (HFC) are capable of carrying up to 500 digital channels. But these services are only one-way in nature, making it impossible for individual users to buy particular information or programming. As with the LECs' bandwidth limitations, a technological upgrade can largely cure this problem; a technological fix can create the missing two-way capacity – namely, adding a miniature switch in a "node" for every 300 to 500 cable subscribers. But this is also expensive.[10]

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[6] 1996 Telecommunications Act §3(b). 47 U.S.C. §153 (2001). LECs generally break down into large incumbent (ILEC) and smaller competitive (CLEC) carriers.

[7] F.C.C. Ann. Rep. (2002).

[8] In the Matter of Appropriate Framework for Broadband Access to the Internet Over Wireline Facilities, 17 FCC Rcd. 3019, 3026 (2002).

[9] In the Matter of Annual Assessment of the Status of Competition in the Market for the Delivery of Video Programming, 17 FCC Rcd. 1244, 1303 (2002).

[10] Botein, *supra* note 2.

The next question is whether these upgrades are economically feasible and/or market-wise for either the telephone or the cable industry.

II. COSTS OF UPGRADES: LECs[11]

Probably the easiest and cheapest means for local telephone companies to add broadband capability to their already switched networks is through DSL deployment. The costs of upgrades vary with the density of the population to be served, however, because of the need for additional "home-run" lines; the terminal equipment would cost several hundred dollars per subscriber. (This cost might fall dramatically with mass production, however, as is always the case with new high-tech products.)

Most telecom engineers and economists price DSL implementation at about $500 per customer for relatively dense areas (central business districts in urban areas).[12] These also are the most desirable markets in terms of customer demographics, since by definition they include commercial entities with intensive data transmission requirements.[13]

On the other hand, service to suburban – let alone rural – areas would increase the cost of the additional network lines tremendously – what most observers view as about $1,000 per subscriber.[14] In working out the potential costs and thus capital generation requirements it probably is safer to use the

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[11] There is no reliable published information in this area. Cost discussions are based on confidential interviews of industry economists and technologists.

[12] Data based on confidential interviews with industry experts.

[13] Botein, *supra* note 2

[14] Data based on confidential interviews with industry experts.

higher and more conservative figure.[15] Results from this analysis then can be compared with those under lower penetration scenarios.[16]

III. COSTS OF UPGRADES: CABLE[17]

State of the art cable systems might have slightly lower costs than LECs.[18] Assuming that a cable system has implemented hybrid fiber optic coax technology, (HFC), both users and central processing units would need just minor hardware upgrades. Most advanced HFC-based systems already include the basic technology for this in subscribers' converter units and operators' central offices ("head-ends").[19]

The only major increase in terms of hardware would be the addition of the "nodes" and home-run cables.[20] Nodal switches cost about the equivalent of personal computers.[21]

Moreover, the addition of the home-run lines would be considerably less expensive with HFC than with DSL. As noted, DSL has a range of only about three miles.[22] By contrast, with a few amplifiers, cable home-run lines can run

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[15] Botein, *supra* note 2.

[16] *See id.*

[17] *Supra* note 8.

[18] 1992 Cable Act, 47 U.S.C. 543 (2001).

[19] *Supra* note 8.

[20] *Id.*

[21] Data based on confidential interviews with industry experts.

[22] Botein, *supra* note 2.

more than ten miles back to the head-end.[23] And a pure fiber line would have a range of up to 30 miles without amplifiers.

For relatively basic switched purposes – e.g., high-speed modems, video on demand – cable nodes most likely have a cost advantage over telephone DSL. However, even the best nodal HFC systems today are not as reliable as traditional telephone copper lines. Although figures are unclear, the cable industry seems to accept that nodal HFC systems have a reliability of above 95 percent – compared to LECs' figures of close to 100 percent.[24] The difference is probably not determinative for video or data uses, but it is vital for traditional telephone applications – particularly emergency, "911" communications. Cable operators privately admit that the possibility of not delivering an emergency call raises insurmountable specters of legal liability.[25] While cable systems can possibly implement a video or data switched system at a lower cost than the LECs could, at least in the foreseeable future, they could not offer reliable telephone service – leaving this major revenue stream available only to the LECs.

This assumes that most cable systems will implement one-way high-capacity HFC systems shortly, but this upgrade is going very slowly, because some major companies have started almost from scratch.[26] Although HFC implementation figures vary greatly from one company to another, the industry as a whole will, almost certainly, not even change to one-way high-broadband capability in the near future. Until most cable systems operate in this fashion, however, the addition of nodal switching will be difficult or at the least, very expensive. In part, because of the cable industry's particular Wall Street woes in 2001 and 2002, most companies' capital expenditures have declined over the last

[23] Data based on confidential interviews with industry experts.

[24] Data based on confidential interviews with industry experts.

[25] Data based on confidential interviews with industry experts.

[26] Bill McConnell, *FTC Turns DTV Sites on Cable,* BROADCASTING & CABLE, Aug. 12, 2002, at 10.

two years.[27]

Cable thus seems to have a significant advantage in terms of offering interactive video/data service. Its inability to offer telephone service in the near future as well as the slow build-out of HFC systems indicates that this advantage is not likely to come into play soon.

IV. SOURCE OF FINANCING: EQUITY

Sale of equity is a traditional method of raising capital financing for new ventures –particularly high-tech applications. It seems questionable whether equity has any possible role in broadband today. Long-distance, LEC, cable, and other telecom stocks already have taken a considerable fall. For example, as of Fall, 2002, AT&T shares were selling at about fifteen percent of their Fall, 2000 price.[28] Perhaps more alarmingly, some economists believe that, of the approximate five trillion dollar sell-off in United States publicly traded shares over the last two years, more than ninety-five percent came from media-related sectors.

This suggests that the only possible financing for the superhighway would be the debt market, for both the LECs and the cable companies. Although debt is more easily available than equity for both industries, it is less than clear that either industry's financial prospects support the type of debt potentially involved with the electronic superhighway.

V. COSTS AND AVAILABILITY OF DEBT: LECs AND CABLE

[27] Data based on confidential interviews with industry experts.

[28] This is a global phenomenon. During the same time period, shares of France Telecom plunged from more than $200.00 to about $7.00.

COMPANIES

With these parameters in mind, it is possible to assess the viability of debt financing for the information superhighway using the LECs, cable, or both. No definite numbers are publicly available. For example, SBC Communications, Inc. (SBC) reported that for 2001 it had budgeted $6 billion to create the infrastructure for a DSL network reaching most of its 25-million wireline customers.[29] Under either the optimistic $500, or the conservative $1,000 per subscriber construction costs (estimated above), this does not seem realistic. Moreover, informal reports in the Fall of 2002, indicated that SBC was planning to cut this $6 billion figure in half. Indeed, the general trends among both mass media and telecommunications companies have been to sell assets to reduce debt.[30]

It may be more useful to look at a more contiguous area of the country – the Northeast– and to contrast the likely debt position of the incumbent LEC – Verizon – as well as that of a major cable company, Comcast. (Upon its acquisition of roughly ten million cable subscribers from ATT towards early 2003, Comcast became the largest United States cable operator).[31] This analysis does not include wireless communications, which lacks enough bandwidth for high-speed data or high-quality video.

But the cable industry has also had problems with capital investment. Cablevision Corporation, one of the four largest U.S. operators, recently indicated that it was virtually halting new capital construction.[32]

A. *LECs*

[29] Even under the optimistic $500/subscriber assumption, servicing all of SBC's customers would seem to imply costs of more than $10 billion. SBC Communications, Inc., Securities & Exchange Commission Form 10-K, at 4, January, 31, 2002.

[30] *Wall Street Journal Abstracts,* N.Y. TIMES, Sept. 9, 2002, at C1.

[31] Comcast Corporation, Securities & Exchange Commission Form 10-K, at 25, 31 January 2002.

[32] John M. Higgins, *Cablevision: But What Vision?,* N.Y. TIMES, Aug. 12, 2002, at 12.

To provide the NII's universal service would require reaching about 30,000,000 subscribers in the Northeast, (this number is approximately the same as the number of wireline users currently served by Verizon).[33] Thus, the optimistic technological model would require a company to raise $15 billion, the conservative model $30 billion.

Debt is always available for going concerns on some terms. The question is: which ones? Verizon is now carrying about $46 billion in long-term debt with revenues of $67 billion.[34] Universal-broadband implementation would make its long-term debt $76 billion -- $10 billion greater than its operating revenues. This number naturally will decline over the years; most long-term debt in the telephone industry runs for 8-10 years, so the present debt will decrease in the foreseeable future. Nevertheless, in the short term Verizon would be carrying a large amount of debt.

All of these factors would naturally affect an LEC's bond ratings, and hence affect the level of new debt interest payments. Although most LECs have traditionally enjoyed very high ratings, this has begun to change in today's financial and stock market environment. Moody's recently downgraded Bell South's rating, and has indicated that it may do the same with SBC and Verizon.[35]

Moreover, universal broadband service is not exactly a lead-pipe cinch to yield strong returns. Lenders of all types burnt their fingers rather badly during the "dotcom" frenzy at the turn of the millennium, and thus, are less than anxious to invest in new markets without proven returns.

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[33] *Verizon Company Profile, Wireless* at http://investor.verizon.com/profile/wireless.html.

[34] *Bell Atlantic Corporation, Verizon Communications, Inc. 10-K filed on March 20, 2002*, Hoovers Online, March 8, 2003 at http://hoovers.10kwizard.com/filing.

[35] A Moody's executive recently included telecommunications in a group of "very weak industries" in terms of debt availability. Alan Beattie, *Companies Shun Credit to Cut Debt & Prop Balance Sheet,* FINANCIAL TIMES, Nov. 1, 2002, at 3.

Debt financing for LECs, such as Verizon, is likely to require a significantly higher interest rate than the past eight to nine percent range. Although predictions are impossible, several economists have privately projected rates in the twelve to thirteen percent area. This is higher than what cable companies have paid in the past.[36] These numbers are not particularly attractive to lenders or LEC investors, as they seem to be headed down the slippery slope towards junk status.

Assuming even relatively modest interest increases for LECs, the cost of the transaction would naturally increase dramatically. As a rough estimate, the per-subscriber bond service cost would be about $500 per year. This figure includes interest, principal retirement and operating costs. In order to show even a modest profit, this would require subscriber prices of about $50 to $60 per month – at or above what a limited number of people are willing to pay for high-speed cable modem service.

Most consumers simply are not willing to pay this kind of money for broadband service. At the end of 2001, BellSouth reported just over seven percent DSL penetration Verizon only about four percent.[37]

All new technologies go through a cycle of slow initial growth, which usually is followed by explosive expansion in their later decades of operation. For a lender, there is no way to project this, and the "dotcoms'" crash and burn scenario certainly does not inspire enthusiasm.

B. *Cable*

[36] Data based on confidential interviews with industry experts.

[37] Ben Charney, *Bell South Hangs Up DSL Phone Service*, News.com, COMMUNICATIONS, January 31, 2003 at http://news.com.com.

The outlook for the cable industry is only slightly different. The cost of capital for cable would be somewhat higher, simply because the cable industry has only a 20-year run of substantial profitability, while the LECs have 120 years. Moreover, cable faces more intense competition for its core video business terrestrial satellites, from broadcasting and naturally from the LECs as well.

Cable systems generally pay about ten percent for long-term debt.[38] Because of the same risk factors facing the LECs, cable operators are likely to pay rates in the fourteen to fifteen percent area.[39]

At the same time, some cable companies may have significantly lower capital and operating costs than LECs, as noted above. For example, Comcast reports that virtually all of its current subscribers need only a relatively minor electronic upgrade for cable modem service.[40] Comcast also reports that it has approximately ten percent cable modem penetration.[41] This higher than the LECs have been able to achieve with DSL. It is not clear, however, to what extent these systems are two-way, and how much work is necessary to make them fully interactive. Again, implementation of nodal switching is the other big capital item for cable systems.

As noted above, operating expenses for cable systems may be lower than those for LECs. The variations in sophistication among systems, however, make predictions difficult.

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[38] Data based on confidential interviews with industry experts.

[39] Data based on confidential interviews with industry experts.

[40] *How Do I Upgrade My Cable Services from Analog to Digital?* at https://www.comcast.com/support/corp1/ FAQ/FaqDetail-209.html.

[41] *Comcast Reports Growth in Revenue, Cash Flow, Cable Modems and Digital Services* at http://www.convergedigest.com/mergers/financialarticle.asp?ID=5393 (last visited Oct. 28, 2002).

VI. OTHER BROADBAND CONFIGURATIONS

The information superhighway is probably not economically viable in today's marketplace, but other broadband approaches may make more sense. Broadband makes the most sense in urban central business districts.

For example, an investment of $2.5 billion to serve the lower half of Manhattan would require annual revenues of about $1.25 billion to service and debt and return net income of more than twenty percent. This amount translates into 1,250,000 business lines at $1,000 annually for broadband service; and large financial corporations obviously would need many more than just one line to service their broadband needs. This would benefit only business users, and big corporate users would gain the most. It would do nothing for "information-poor," who were the original intended beneficiaries of the electronic highway. Moreover, all four RBOCs are experiencing declines in their total number of subscriber lines.[42]

CONCLUSION

The original vision of the information superhighway thus seems to have disappeared. Instead, we are left with the traditional Internet. It is not a bad communications device, but it is certainly not a means of bringing individuals and educational institutions to a new intellectual level.

Could the government have acted to insure implementation of the superhighway? To the extent that the problem is lack of interest from the private sector to take a chance on a potentially low-return technology, government funding–directly, through loan guarantees, tax incentives and so forth–might have

[42] Vince Vittore & Flenn Bischoff, *Access Line Count Evaporation,* Telephony, at http://telephonyonline.com/ar/ telecom_access_line_count/index.htm (last visited Oct. 14, 2002).

made a difference.[43] To the extent that few potential consumers or users have any genuine interest in the program, additional funds – from any source – likely would have made little or no difference.

Thus, this discussion ends where it began: with a question as to the honesty of the United States government in its promotion of a program with potentially great importance to its citizens.

Perhaps the NII was over-engineered and under-designed for general public use. The government's off-loading of its burdens onto the private sector, however, did not promote any clarification as to the relevant applications, constituency, or funding. In effect, the government merely walked away from the whole issue.

[43] For example, the former FCC Chair under the Clinton Administration, Reed Hundt, recently advocated a new federal initiative to build the NII. John Eggerton, *Washington Watch*, Broadcasting and Cable, available at http://www.broadcastingcable.com/index.asp?layout=print_page&articleID=CA250467 (last visited Oct. 7, 2002).