

M.I.T. Laboratory for Computer Science

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**A Policy Analysis of Data Communications via Cable.
A Master's Thesis Proposal.**

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Proposal for Thesis Research in Partial Fulfillment
of the Requirement for the degree of
Master of Science

Title: A Policy Analysis of Data Communications via Cable

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Brief Statement of the Problem:

Wideband transmission technologies for intra-urban signal transmission could offer bandwidth per dollar ratios which are orders of magnitude greater than the telephone company's narrowband local loop. Cable Television (CATV) is one alternative wideband technology for communications within a city. The offering of data transmission services by CATV operators poses particularly interesting questions as to the proper regulatory structure for communication industries which both operate the communication conduit and sell services over it -- pay television, videotex, electronic mail. After investigating the existing technical, market, and regulatory status of CATV-based data communication services the thesis will recommend a proper regulatory framework for local, state, and federal bodies.

Supervision Agreement:

The program outlined in this proposal is adequate for a Master's Thesis. The supplies and facilities required are available, and I am willing to supervise the research and evaluate the thesis report.

Jerome H. Saltzer, Professor of Computer Science and Engineering

Marvin A. Sirbu, Principal Research Associate, Center for Policy Alternatives

1. Introduction

The development of new telecommunication services for **regional distribution** will significantly affect the growth and application of both home and business information systems. Long distance microwave and satellite data transmission services are available which offer greater bandwidth, reliability and flexibility than the telephone company's long-haul network. In addition, in-house high speed data communications is available to commercial, academic, and institutional users via Local Area Computer Networks (LACN). But, there is no **regional network** alternative to the telephone company's narrowband **local loop**. The phone company currently carries both data and voice signals over voice-grade lines between the central office and subscribers. This creates a "last mile bottleneck" for the transmission of high speed data. The regional network, suffers from increasing service charges as well as inadequate facilities. Wideband transmission technologies could offer bandwidth-per-dollar ratios which are orders of magnitude greater than the current narrowband local loop.

"The availability of diverse communications services can provide powerful leverage for greatly enhancing the nation's information-based economy. The weak link now in providing advanced communications services to business and the public is at the (regional)* distribution level. The diversity of services possible through (regional) distribution is being inhibited by traditional views on (regional) distribution and prevailing regulatory policies."¹

Increased use of data communication within a city is a result of expanding inter-city and in-house computer communications, as well as evolving intra-city applications such as: banking, branch communications with central offices, and growing inter-company communications. In addition, there is a potential residential communications market developing to accommodate teletext, videotex, communicating personal computers, messaging, and security systems, as well as other information services that would connect the residential and commercial sectors.

There are several alternatives to the existing telephone local loop, e.g., existing wire-pair facilities modified for digital transmission, cellular microwave, infrared, and Cable Television (CATV). **The use of CATV is interesting and complex because it involves a technology and an institutional framework, both of which already exist, but for wholly different applications.** CATV has been used principally for entertainment television signal transmission, but, given proper system design, it is equally appropriate for transmitting and receiving data to and from the home. Among the alternative wideband regional distribution technologies available, CATV poses the most fundamental and compelling policy questions. Such questions include:

- Is CATV operation a broadcasting or common carriage function?
- Under whose jurisdiction should CATV be regulated -- local, state, federal?
- Should the operator of the network facilities have full control over what services are made available?

¹J.L. Charter, D.N. Hatfield, R.K. Salaman, "Local Distribution -- The Next Frontier", National Telecommunications and Information Agency Technical Memorandum, April, 1981. Available from N.T.I.A., 1800 G. St., N.W., Washington, D.C.

- Will such services compete with the telephone company successfully, and how will the telephone company react?

2. Technical and Market Background

Regional networks fall between local and long haul networks not only in their geographical coverage, but also in their degree of centralization. LACN's are generally 'contained' within the jurisdiction of a single entity -- office, building, plant -- where resources are shared by mutually trusting users, and where the costs of implementation as well as the benefits of usage are incurred by the same party. The assumedly friendly environment allows for less centralized control. Long haul networks are highly centralized to compensate for the distribution and diversity of the users' interests. The telephone company, TYMNET, TELENET, and SBS, are all long haul carriers that allocate both resources and cost between senders and receivers.

Technical considerations in the implementation of a regional data network on CATV facilities include: the most appropriate method of channel allocation, the feasibility of adapting access schemes designed for LACN's to the extended distances covered by regional networks, the incompatibilities that might arise when transmitting video and data on a common cable, and alternative means of interconnection between **CATV-nets**.

Regional CATV network services could potentially serve three markets: commercial and institutional high speed data services; commercial to subscriber data services for banking, transaction, and information services; and subscriber-to-subscriber communication services for mail, messaging, and resource sharing. (Subscribers are residential users, as opposed to institutional or commercial users.) Some of these services present more risk to the CATV industry than do others. Much of the "perception" of the risk, by CATV operators, is related to how the services are structured. A structure in which all communications between the subscriber and the head-end are controlled by the operator -- both transmission and, to some degree, content -- does not arouse the same level of anxiety on the part of the CATV operator as does a structure in which subscribers communicate with other commercial, or subscriber, parties directly. For example, if a set of stores want to provide catalog or shop-at-home services, the CATV operator might purchase the "software" package, or control scheme, from the commercial parties. The operator would offer the services over its cable, charge for them as desired, and communicate the subscriber requests to the commercial parties, generally via the cable. This scenario might be perceived favorably by many operators because of its similarity to the current structure of entertainment CATV services. On the other hand, the following scenario, whose structure is more like that of the telephone company, might be avoided by operators. In this alternative structure, both the subscribers and commercial entities would be considered as "nodes", or points, on the cable communications network. The subscribers would communicate orders to the commercial entities, and the commercial entities would communicate advertisements, catalogs, and receipts to the subscribers. Both parties could pay for their own communication usage, or the commercial entity might subsidize the subscribers' usage.

In addition to the structural differences of these potential markets, the degree of technical sophistication of the users, effects the perceived riskiness of the service. One of the more technically sophisticated services, high speed multipoint data transmission for commercial users, would put CATV operators in direct competition with the telephone company. Even if the technical features of the service via cable are superior, the commercial user is accustomed to a scale of service and reliability that the telephone company can afford, but that CATV Operators are, in general, not prepared to provide. Although the CATV industry as a whole has a good "mean time to failure" record for entertainment video services, data communications services can entail added

complexities. These complexities arise from: the sophistication of the interface devices required for high-speed data, the modified equipment which may be required in the CATV plant to provide wideband upstream channels, and the generation of signals from many points. On the other hand, while residential users are accustomed to the style of service of CATV operators, the markets for HIS banking, retrieval, and inter-residence communications are not at all established.

The installation of systems able to satisfy the data communications needs of institutions and residents requires an investment on the part of the operators. The cost to wire a large city for two-way video and data distribution is estimated to be \$80-\$100 Million. The cost to wire the same city with a one-way system is not significantly lower. Therefore, the "real" cost to the CATV operator, in providing data services, is the engineering knowledge and personnel required. This engineering expertise is vital to the success of data services, but is currently lacking in the CATV industry. Operators are demanding assurance as to the existence of a profitable market for these services, before they are willing to divert the extra labor and capital costs from their traditional programming and transmission activities.

The data communications market has an estimated growth rate of 20% to 30% a year. H. Dordick, in his book "The Emerging Network Marketplace", includes "(t)he shift to optical links and/or cable local distribution communication technologies, which should result in a 50% to 75% saturation of U.S. homes during 1990 to 1995 period"², as a contributing factor to this growth. Dordick concludes that while data communications constitute less than 1% of the total communications market, the revenue could be as high as 18%.

3. Regulatory Framework

CATV is categorized as a broadcasting service and is only minimally regulated by the federal government. Operators are granted franchises and given local monopolies by local governments which last typically fifteen years. On the other hand, telephone and most other transmission services are regulated as common carriers by both state and federal governments. Common carrier regulation has traditionally implied rate of return regulation and two fundamental behavioral stipulations: that services must be made available to everyone on an equal basis; and that there must be no control over the content of communications, only over the carriage.

The dichotomy set up in the Communications Act of 1934 presented an effective barrier to the merging of the content and carriage sectors of the communication media industry. The content sector is made up of broadcasters who, through programming, exert control over the content of the media. In contrast, the carriage sector is comprised of common carriers who control the conduit, or transmission media, over which communication signals are carried, and who are prohibited from exerting any control over the content of those signals. The 1934 act granted the Federal Communications Commission (FCC) jurisdiction over both sectors, with a separate set of provisions for each. In addition, the act stated that services regulated under one set of provisions could not be subject to the other set as well. Until recently there was no difficulty in determining which communication services belonged under which category. Today, just as the dichotomy between computing and communications has blurred as a result of technological developments, so has the differentiation between some common carrier and broadcast technologies.

Home information services are proposed which will deliver text and data via broadcast media which

²H. Dordick, H.G. Bradley, B. Nanus, The Evolving Network Nation, Ablex Publishing Co., 1981, pp. 41-43.

are traditionally used for entertainment video television. Teletext and Videotex services offered by traditional broadcasters and the telephone company offer no significant threat to the existing regulatory model or the public interest because the control over what information is available remains in the broadcasters domain and the control of upstream carriage is with the telephone common carrier. Broadcasters are already limited to the operation of a single channel per region, providing some protection from monopolization of the blanking interval used for text transmission.

CATV, on the other hand, poses a great threat to the separation of carriage and content because operators control both facilities and programming. This combined control has anti-trust implications. Because there will generally be only one cable system per community, the available CATV spectrum within a city will be limited. In addition, while the telephone company offers an alternative, it does not offer a wideband alternative, and will not do so until fiber optics are available for intra-city communications. If cable becomes a significant carrier for information services, it is important that many diverse service-providers be rented access to the cable facilities for transmission to the home. The entire spectrum of the facilities should not be monopolized by the cable operator's services, nor should the cable operator be given ultimate discretionary powers in refusing or granting transmission service. In short, common carrier structure serves an important function in the allocating of scarce resources in our society.

These services developed in a hybrid manner because the FCC has not clearly determined what the true role of these services should be - broadcasting or common carrier. The FCC has hesitated to effect separations particularly due to the claim that without the control over programming and the direct service of the subscriber market, the systems will have trouble developing at all. Initially this hesitancy to regulate was appropriate to CATV's immaturity as an industry. Today, because CATV operators continue to use enhanced television programming to increase their market demand, they have been slow in moving on to systems which will be adequate for data information systems as well as video.

Centralization of the control over content and carriage also increases the dangers of privacy violation. Actually all home information systems are a danger to personal privacy by the mere fact that they provide a channel by which information can flow from within one's home to the outside world. But the more direct the connection between the information source and sink, the more motivation there is for invasion of the individual's privacy in accessing information, literature, and other people. D.C. Nash and D.A. Bollier describe four types of exposure that consumers risk with interactive home media: intrusion, interception, misuse of information and aggregation of individual or household information³. The diversity of channels through which we currently communicate with others has helped to shelter us from these abuses, i.e., telephone, postal mail, on-site business transactions.

4. Thesis Format

The first section will provide the technical and market background necessary for the ensuing discussion. The body of the thesis will analyze the regulatory issues, with emphasis on: common carrier v. broadcast regulation, antitrust implications, jurisdiction, and privacy. The final section will draw conclusions based on the technology, economic, and policy issues presented, and will synthesize recommendations for local, state, and federal treatment of CATV.

³D.C.Nash, D.A.Bollier, "Interactive Home Media and Privacy Issues", Collingwood Associates and the Federal Trade Commission -- Office of Policy Planning, 1981. Available from Collingwood Associates, Washington, D.C.

5. Schedule of Tasks

- Eighty hours of background reading and research -- 4/81-9/81.
- Eighty hours of additional research, interviews, reading -- 10/1/81-11/15/81.
- Eighty hours of formulation and writing -- 11/15/81-1/15/81.

6. Bibliography

1. J.L. Charter, D.N. Hatfield, R.K. Salaman, "Local Distribution -- The Next Frontier", National Telecommunications and Information Agency Technical Memorandum, April, 1981. Available from N.T.I.A., 1800 G. St., N.W., Washington, D.C.
2. H. Dordick, H.G. Bradley, B. Nanus, The Evolving Network Nation, Ablex Publishing Co., 1981.
3. D.C. Nash, D.A. Bollier, "Interactive Home Media and Privacy Issues", Collingwood Associates and The Federal Trade Commission -- Office of Policy Planning, 1981. Available from Collingwood Associates, Washington, D.C.

7. Appendix -- Proposed Outline of Thesis.

A Policy Analysis of Data Communications Services via Cable.

I. Introduction.

II. Is Cable Television A Bottleneck Medium?

- A. Technical Background.

- 1. CATV Network Capabilities and Limitations.**
- 2. Other Local Loop Technologies -- Telephone Company Alternatives.**
- 3. Future Developments -- Fiber.**

- B. Market.

- 1. Services and Market Development and Projections.**
- 2. CATV Economics.**
- 3. Operational Requirements for Success: Availability, Reliability, Security.**

III. Appropriate Regulatory Framework.

- A. Common Carrier v. Broadcaster.

- 1. Cable Operations.**
- 2. Regulatory Alternatives -- Behavioral and Rate Regulation.**
- 3. Legislative and Judicial Precedents.**

- B. Antitrust Implications of CATV as a Bottleneck Media.

- 1. Monopoly Power.**
- 2. First Amendment Issues.**
- 3. Separations.**
- 4. Leased Access.**

- C. Jurisdiction.

- 1. Federal Regulation.**
- 2. State Regulation.**
- 3. Local Franchising.**

- D. Privacy Implications.

1. Wiretapping.

2. Intrusion.

3. Misuse of Information.

IV. Recommendations.

- A. Local Government Franchising Boards.

- B. State Public Utility Commissions.

- C. FCC and Congressional Action.

- D. Cable Industry.

- E. Transaction Industries.