HyperCard concept are now becoming available such as Silicon Beach's "SuperCard," Olduvai's "Plus," and even some loosely related products on the IBM-type PCs.

The concept now extends far beyond Ted Nelson's original "HyperText" to include all types of media. Therefore, it is coming to be known as "**HyperMedia**." A comparison of the three types of information linkage discussed in this section is shown in Figure 4–2. HyperMedia is able to establish paths directly between elements that may be on different levels or even different primary paths within the hierarchical structure. One company, HyperX (Irvine, CA), was established solely for the purpose of developing HyperCard software which learns the individual's path preferences and establishes intelligent shortcuts to allow direct paths when advantageous.

4.2.4 Computer Search

Even without indices and elaborate linkages it is possible for a computer to search a vast amount of stored and/or transmitted data for the desired information. A simple example is the "Find" function included in virtually every word processor. This function allows a word or phrase to be specified for the search. Certain freedoms can usually be allowed so that an exact match is not required. For example, the case of the characters can be ignored, and sometimes "wild card" symbols ("*", "?") are allowed.

The most general such function is probably the "GREP" of UNIX wherein various logical combinations of conditions can be specified to guide the search. The search can be extended far beyond one document to an entire disk of documents or a long stream of received data. This is certainly an additional benefit of electronic publication which could not be done otherwise.

4.3 Static Information

What we call "static" information might more aptly be called "long-term" or "relatively stable" information. It is the "archival" category of communication that was mentioned initially. This information can be available on floppy disks, hard disks, DAT tape, 8 mm tape, CD ROM, CDI, DVI, recordable CD, LaserDisk , and other magnetic and optical recording means. The cost of mastering a CD ROM has now dropped to less than $500 and the individual production cost to less than $2. It was no exaggeration when Microsoft titled one of their books *CD ROM—The New Papyrus*.

Recordable CDs and their recorder-players are still relatively expensive, having been on the market for only a few months. However, there is no inherent reason to believe they will not follow the same declining-cost learning curve as read-only CDs.

Electronic CD ROM publication cost is now much less than paper for many applications. For example, a white-pages phone book for the entire state of California can easily fit on one CD ROM. Compare that with the cost of having a few shelves of phone books. With CD ROM, the information is also readily accessible to the computer for other purposes besides being available to the individual.

Apple Computer and others have found that HyperCard is the ideal vehicle to make the massive amount of information and programs contained on CD ROM available to and navigable by the average and not-so-average user. There are now many companies devoted exclusively to this type of product. For example, there is a several-CD set which covers the history of western civilization. There are CDs and HyperCard stacks that can replace much of what fills multitudes of shelves of law libraries. Apple computer now distributes to its developers all of its system software, programming aids, and developer aids on HyperCard "stacks" on CD ROM.

HyperCard has proven itself as the ideal controller and companion for LaserDisk . Voyager, Inc. offers many LaserDisk , such as for the National Gallery of Art, the Louvré, and many others. All of the relevant text and control information is contained in and extensively cross-referenced in HyperCard stacks for any particular subject and includes the indices for accessing and displaying photographs, video sequences, and related subjects from the LaserDisk .

HyperCard has also proven itself as an ideal educational tool. It serves as a relatively simple authoring environment for programmed learning, homework, and exams. In fact, children in early elementary school in the Los Angeles Vivarium project develop and program their own HyperCard stacks. The educational potential for this type of medium is absolutely incredible and has hardly been tapped. We could go on and on with examples of what is being done and what could be done with HyperMedia electronic publishing.

Distribution of static media can be accomplished by numerous means:

- Purchasing from a store or by mail-order;
- Borrowing from a library or leasing;
- Slowly downloading over telephone lines via modem;
- Downloading through a cable system, if such service were available;
- Someday, in some areas, downloading through fiber-optic links;
- **Rapidly and inexpensively downloading anywhere in the country via ACC's Digital DBS.**

We have barely scratched the surface here, but for now we must continue on.

4.4 Dynamic Information

"Dynamic" information is relatively short-term. This can be the "news" category previously mentioned. However, it can also be "educational," such as from a local instructor or by distance learning techniques also previously discussed. "Archival" information can also be presented in a dynamic format such as the broadcasting of movies, previously recorded programs, and circulating reference information.

Dynamic information requires relatively fast conveyance. Telephone calls can convey limited amounts of information almost instantly. Radio and TV broadcast usually convey information at fixed, periodic intervals (e.g., a news broadcast) although urgent information can be inserted almost instantly ("The world ends at 8 PM—details at eleven."). Newspapers are usually daily and magazines weekly or monthly. Electronic publications do not have such rigid constraints of schedule or physical delivery. Whenever the information is ready for dissemination, it can be "published," i.e., made available to interested parties.

Access to dynamic information can be tailored to a individual's specific taste and preferences. On most electronic services, one can specify particular subject areas and branches of the file hierarchy to peruse or download. In a similar manner, a high-rate data stream can be selectively downloaded by subscription-authorized service and by index into the users computer memory (hard disk, recordable CD, or tape). HyperMedia crosslinking may require several passes (retransmissions) of the information before all of the relevant information is captured by the user's computer. The same would be true for a semi-intelligent computer agent, such as HyperX, which learns the users interest and preferences.

Once the selected information base is available within the computer, it is prioritized and organized for presentation to the user. For example, a newspaper front-page-like format could be generated for the first screen presented on the Eltron. Articles could be continued by simply touching the appropriate part of the screen. (Because of the ease and speed of text linkage, it may be advantageous to present more headline topics and less body text on the first page.) This electronic newspaper would include other news of special interest to the user, such as from professional and hobby publications.

Because of the information prioritization and HyperMedia organization, the subscriber can delve into a particular subject to as deep a level as desired, at least to the extent that has been captured by his own base computer. The user could also specify that he wants to more closely follow a specific thread of news in the future.

Trade journals are another area which will benefit immensely from this technology. The entire structure of journals and their contents will be radically different, along with the method of delivery. Indeed, the entire concept of scientific, medical, and engineering journals will be different. Each article will be HyperMedia based and may even contain information as detailed as raw experimental data. Only those who are interested in such level of detail need access it. Others' PCs may only capture the summarized data charts and basic write-up. The subscriber may only access that particular article's title and abstract. Delivery can occur whenever the article is ready for publication and has received the prerequisite reviews, rather than waiting months for today's usual publication cycle.

Some of the software tools required to accomplish these types of functions have already been developed and are continually being improved for use on computer network services. However, they are implemented on the main-frame computers which operate these services, rather than on the user's own computer. The amount of processing capacity allocated to each user for this purpose is typically very small. Also, telephone line communication (at 1200, 2400, or even 9600 bps) is exceedingly slow for transmitting large amounts of information, even more so when including graphics, sound, or animation. This is also exacerbated by the need for real-time interaction and fast graphics-screen response. As a result, most news services for personal computers are very shallow in their presentation, depth, and breadth.

As for static information, some of the means possible for transmitting dynamic electronic publications are:

- Slow transmission via modem from subscription services (e.g., Compuserve) over telephone lines;
- Cable systems, if such service were available;
- Someday, in some areas, fiber-optic links;
- **Rapidly and inexpensively, anywhere in the country via ACC's Digital DBS.**

High data-rate transmission, inexpensive local storage capacity, increased PC processing power, reasonably intelligent software, and the high portability of the Eltron will be combined to overcome the previous obstacles. The relevant (and potentially relevant) information will be extracted from the high data rate stream and stored for later real-time access. Software will perform memory management and purge older, less relevant information to insure adequate available memory capacity for new, more relevant information. These factors will result in a dynamic electronic publishing service which will be far superior to any kind of publishing service that exists today.

4.5 Advertising

Totally-paid subscriptions may be adequate to finance many types of electronic publications because the cost of publication and delivery is so low. However, many types of publications are simply not feasible and would not exist without advertising. The same will likely be true for electronic publications.

The "Prodigy" information service (IBM and Sears) for PCs charges a flat subscription fee of $10/mo. However, the service is supported by advertising that appears regularly at the bottom of the subscriber's screen. The system learns the user's interest categories by observing his pattern of service usage and tailors the type of advertising to match. The advertiser never gets the list of prospects but is simply informed of the number of users matching his profile who will see the ads.

Advertising can also be done using HyperMedia. In fact, this can provide a quantum jump in the effectiveness of advertising by allowing ads to be targeted according to individual preferences, interest, and even vulnerabilities. A properly designed HyperMedia advertisement would lead the potential customer down a path of intrigue to the "pièce de résistance" in a manner not possible with today's advertising—and it would even dial the phone to make a sales appointment or to order the commodity or service (with the subscriber's permission, of course).

5.0 ACC's Digital DBS Delivery

In previous sections, ACC's Digital DBS has been mentioned mostly in passing because we first wanted to lay the groundwork for where we are going. There are many types of services which will be offered from these satellites. Electronic Publishing is only one of them. However, it is a very significant part, having a potentially significant impact on the future of mankind. In this section we will specifically treat ACC's Digital DBS as a means to deliver these services.

Many of the described services could someday be delivered to at least part of the population by cable, fiber-optics, or even local over-the-air broadcasts, assuming newly available radio spectrum from FCC cooperation, and a significant investment. However, ACC's Digital DBS will shortly reach the **entire** United States including areas which will likely never see cable. Also add to that the population that uses information while mobile—cars, trucks, boats, and airplanes—impossible to connect by cable. After introduction of Digital DBS services, it is only a matter of time until someone designs a phased array DBS antenna which can be kept pointed to the satellite and can be imbedded in the roof of a car, boat, or truck or in the skin of an airplane.

But enough of predictions and on to some of the specifics of publishing that can be offered from ACC's Digital DBS.

5.1 News

The potential and mechanics of a customized HyperMedia news service have been discussed previously. Suffice it to say that a fraction of one of ACC's 27 Digital DBS transponders could provide this service to the entire nation including all the specific news areas necessary for customization. Local news could also be included for all communities who wish to be included in this service.

Many of the particulars of signal format and indexing have not been determined yet. However, it is safe to say that separate indexing channels (or a hierarchy of such) will be provided far enough in advance so that a receiving computer could decide what information it wishes to extract for its local news database. Depending on the particular cross-referencing, several passes of the transmitted information may be necessary to adequately establish the local database for deep browsing.

5.2 General

General information delivered by Digital DBS can be either dynamic information, such as that mass of wood-pulp that lands on the doorstep before 6 AM or is received on the radio while stuck in

a traffic jam; or static information that is basically archival but may not be readily available though other means. It is intended that ACC's Digital DBS would provide both of these types of services.

5.3 Specialized

Specialized information is that which is directed to a specific group of people. This could be from professional organizations, hobby groups, humanitarian groups, religious groups, emergency services, or any other group of people who desire to have virtually instantaneous nation-wide information dissemination.

5.4 On Request

There will be times when the information available through standard broadcasts will not be adequate for the desired purpose. Several options might be available:

- Access the desired information by telephone-line modem, pay the connect time and long-distance charges, and slowly download the information;
- Request the information by mail or modem and have it delivered on disk by mail;
- **Request the information by modem and have it delivered at high data rate through ACC's Digital DBS.**

The cost of such a service would depend on how soon a response is required and whether or not other people are requesting the same information. For example, if a large number of people were requesting the same best-seller book, and overnight response is adequate, the charge to download the book might be nominal. If a request is received from a small group for a specific archived technical article and the subscribers want it within the next ten minutes during the business day, then the charge would be higher. Home delivery of recordings could also be handled by subscription and/or requests. If a popular recording is requested and overnight delivery is adequate, then delivery would

6.0 Conclusion

As we have amply shown, the technical capability now exists to implement a nationwide electronic publication distribution system through ACC's upcoming Digital DBS system. It is now a matter of system, hardware, and software engineering, optimization studies, designing the human interface, demonstration service trials, and of course, paying for all of the above. At the very least, we should make sure that the Digital DBS transmission format and home receiver hardware and software have the necessary "hooks" (interface characteristics) to not preclude electronic publication services.

This is truly an exciting time. The electronics revolution has really only just begun. Electronic HyperMedia publications, distributed by ACC's Digital DBS, will forever change our concept of the publication medium and the world will be better place to live because of it. New business expansion opportunities abound for the insightful publisher.

Acknowledgments

The authors would like to thank Daniel H. Garner and Donald K. Dement who contributed in various ways toward the creation of this paper.

Appendix A Vita

Dr. G. Gordon Apple - President, Advanced Communications Engineering, Inc. Dr. Apple received his BSEE degree from the University of Arkansas in 1966 and an MSEE and PhD from Purdue University in 1967 and 1970 respectively. He has over 25 years experience in digital communications spanning the telephone, computer, space, and defense industries. Dr. Apple has patents in the fields of error correction coding, digital transmission, synchronization, and video data compression. He also has various publications and has made many presentations (including internationally) on these subjects. Dr. Apple is a Senior Member of IEEE, a member of Sigma Xi (research society), Eta Kappa Nu, Tau Beta Pi, Pi Mu Epsilon, and the Society of Motion Picture and Television Engineers. He is a Registered Professional Engineer and an instrument rated pilot.

While at Purdue, Dr. Apple developed a transform-coding digital filter for NASA on a research contract. He then worked at Bell Telephone Laboratories on digital-interframe-coding video-compression techniques for PicturePhone® transmission. At North Electric he headed up a group which developed transmission, synchronization and multiplexing systems for a new digital telephone switching system. He then was Director of Engineering for Automation Products Company. At TRW, Dr. Apple was involved in and did project management for many digital communication system projects including satellites, modems, and data compression systems. He served as system engineer on the Space Shuttle's primary communications system (for which he received award recognition from NASA) and served as system engineer on a number of satellite programs including Mod-35, TDRSS, OMV (Orbiting Maneuverable Vehicle) and classified programs. He more recently served as the C-band system engineer on the Intelsat VII proposal, partly in Toulouse, France, jointly with MATRA.

Dr. Apple was a system engineer for development of a secure-voice terminal (for Ft. Meade) and developed the KDC (Key Distribution Center) protocols and signal formats used for exchanging crypto-keys in this system. He was the system engineer for the project that developed the television satellite transmission scrambling system that was TRW's entry into this field in competition with the (winning) VideoCipher scrambling system.

Dr. Apple was principal investigator and project manager for a joint effort with CBS Television to develop data compression for High Definition Television (HDTV) using digital transmission via Direct Broadcast Satellites. He also served as assistant Program Manager for VHSIC (Very High Speed Integrated Circuit) ground terminals for the MILSTAR satellite system—by far the most sophisticated communications satellite ever built. This was a pioneering program which was the first

to incorporate the most powerful and advanced digital-signal-processor ever designed. He was then principle investigator for IRAD (Internal Research and Development) programs for small, light-weight EHF (Extremely High Frequency) terminals. He developed a system design for an ultra-small VHSIC Phase II (wafer-scale integrated circuit) EHF satellite communications terminal and proposed (to NSA) a unified cryptographic integrated circuit design for use by the Air Force.

In recent years Dr. Apple has devoted his efforts toward concept development, system design, and promotion of digital transmission for DBS broadcasting of television, HDTV, educational services (e.g., the YES Networks), electronic publishing, and other services. In particular, he pioneered the concept of using personal computers to (digitally) broadcast services directly to televisions and personal computers. He has also been actively engaged in extending the concept of "object-oriented programming" across boundaries between multiple diverse processors and dedicated hardware, particularly between personal computers and embedded signal processors.

G. Gordon Apple, PhD
Advanced Communications Engineering, Inc.
722 S. Broadway #30
Redondo Beach, CA 90277
213-540-6532

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Technical Feasibility of Syndex for Satellite Broadcasts

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Netlink U.S.A.
Southern Satellite Systems, Inc.
Superstar Connection

By:

G. Gordon Apple, PhD
Advanced Communications Engineering, Inc.

Ron D. Katznelson, PhD
Multichannel Communications Sciences

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1.0 Summary

The use of VideoCipher®[1] to implement Syndicated Exclusivity (Syndex) in the existing satellite broadcasting industry is shown to not be technically or economically feasible now or in the foreseeable future. The one existing technical paper (Cooperman & Gould[2]; hereafter refered to as "the C&G paper"), which supports the short term implementation of Syndex, is shown to be based on cursory and erroneous information on the VideoCipher II, the proposed vehicle of implementation. The following is established:

- The implementation schedule suggested by the C&G paper is impossible;
- Delay of introduction of the VideoCipher II-Plus to allow implementation of Syndex could cause descrambler shortages and severely impact the satellite broadcasting industry's efforts to control signal theft;
- The cost to modify most existing VideoCipher units for Syndex is in the vicinity of $250,000,000— for which the subscriber would receive an inferior service;
- Syndex, implemented by VideoCipher, could easily be defeated by technical means which would also encourage piracy;
- Syndex can be easily defeated by non-technical means;
- Syndex would cause unacceptable channel access delays for **all** subscribers while excluding a very few.

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1 VideoCipher is a trademark of General Instrument Corporation (GIC).

2 Cooperman, Richard S., and Richard G. Gould, "Technical and Economic Feasibility of Syndicated Exclusivity in Satellite Delivery of Television Broadcast Signals to Home Satellite Receivers," July 29, 1989, a study prepared for: Association of Independent Television Stations; Motion Picture Association of America; National Association of Broadcasters.

2.0 Introduction

Initially, satellite television ground stations were far too expensive to be considered for individual home use and required an FCC license. At this time, unauthorized reception was not even a concern. As the ground station price dropped to below $10,000 and the FCC withdrew the receive-only licensing requirement, individual ground station sales grew strongly. As the proliferation of individual home ground stations passed into the hundreds of thousands of units, concerns were expressed that home satellite reception was an improper activity, and that this had become an illegitimate industry because it was engaged in theft of service.

Home Box Office (HBO) was the first to seriously consider protection of its satellite broadcasts, and issued an RFP (Request for Proposal) in 1982. This resulted in the original VideoCipher. The later VideoCipher II (VC-II) was designed to be less expensive and either be included as a module within a satellite receiver or be used as a stand-alone descrambler.

The introduction of full-time VideoCipher scrambling in January 1986, and the prospect of scrambling on other channels, was very effective. Within a very short time, sales of the once booming industry for individual home ground stations slowed to a trickle, even though most programming was available for subscription or still was unscrambled. **This clearly shows the effect of user perception** upon this type of commercial market.

Satellite viewers, who had spent thousands of dollars on receivers, felt that they had an inalienable right to continue receiving satellite broadcasts. For a period of time after scrambling began, production of descramblers for the home market lagged. As a result, subscriptions and sales in this market remained low for a long time. **This unnecessarily crippled the U.S. satellite receiver industry.** Now, in view of the upcoming markets for Direct Broadcast Satellites (DBS) and High Definition Television (HDTV), we must be careful not to repeat this error through additional delays.

Some of the syndicated programming contracts with local television stations and/or cable systems include provisions for exclusive rights to service within a local area. (By law, this contract exclusivity cannot extend past a 35 mile radius from the transmitter.) A requirement to honor such exclusivity agreements has now been imposed on the cable companies.[1] The question has further

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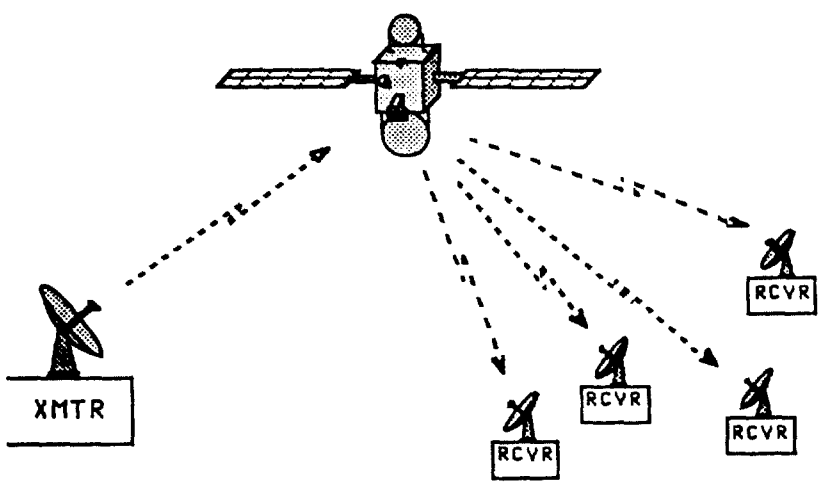
1 The authors note that CATV syndicated exclusivity rules are currently subject to a legal challenge in the United States District Court for the District of Columbia..

been raised as to whether or not it is possible, feasible, or desirable to impose it on satellite distribution.

There are obvious differences between satellite distribution and terrestrial distribution, whether cable or over-the-air. Television stations are rooted to their transmitters and their signals have inherently limited transmission distance. Cable systems are even more well defined because their extent is determined by the physical placement of cable. Satellites, on the other hand, broadcast their signals uniformly across the country without regard to city, state, or Syndex boundaries. Therefore, if controlled access according to location is desired, other means must be found. Presently, the only available means of any kind of controlled access is through use of the VideoCipher II.

The VideoCipher II can be individually addressed for purposes of initialization, passing the monthly encryption keys, selection of authorized service tiers, and limited blackout capability. The question examined in this paper is whether or not it is technically feasible to use the VC-II, or its later incarnation—the VideoCipher II Plus (VC-II+), to implement partial or full Syndex to the level desired.



3.0 Syndex in the Existing Market with VC II

The C&G paper states that implementation of Syndex is possible with the existing VideoCipher II. For the following reasons, we submit that no form of Syndicated Exclusivity is feasible in the existing market:

3.1 Blackout Control by Region

Signals transmitted from most television broadcasting satellites reach all areas of the country equally without regard to specific locations or Syndex clauses in contracts. It is totally beyond today's technology to be able to black out specific small areas while still maintaining transmission to a much larger area. Therefore the system must be capable of enabling and disabling individual descramblers within a specific area which is to be blacked out. The goal would be to black out precisely those receivers within the Syndex area while not blacking out any of the receivers outside of that region. Implementation of such a scheme requires three elements:

- The ability of the system to determine the precise location of each receiver within the system;
- The ability to communicate information about the blackout areas for each program to the individual descramblers;
- The ability to quickly send "global" commands to large groups of descramblers in order to begin and end the blackouts without imposing unacceptable access delays.

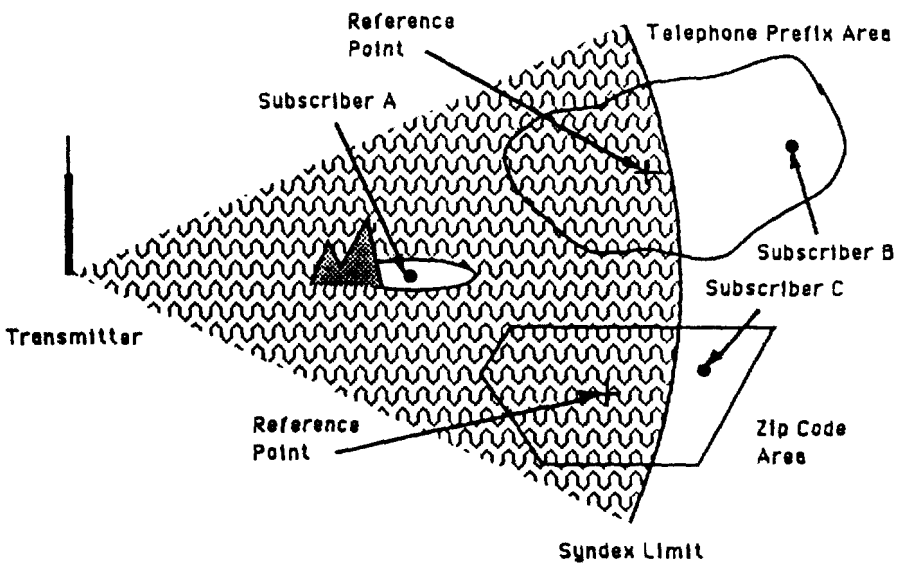


Figure 3.1 Problem Areas for Syndex Regions

We will examine various methods which could be used to effect Syndex blackout and address specific methods which would be required by VC-II hardware and show why such methods are not feasible. We will also examine present limitations and weaknesses within any such system.

3.2 ZIP Code

The method that the VideoCipher uses for blackout control is exclusion by particular Postal ZIP code furnished by the subscriber. Anyone with a postal address within that ZIP code can then be excluded from receiving syndicated broadcasts if the representative location (the Post Office) is within a specified radius of the television transmitter of the syndicated area.

Assuming for the moment that the ZIP code can be correctly determined, an obvious inaccuracy in this scheme is that the ZIP code areas have highly irregular shapes, resulting in very coarse estimates of the coverage area. The question arises as to whether exclusion should be based on the largest area within which customers can be guaranteed to be within the 35 mile legal exclusion limit, or should be based on the smallest area within which **any** customers within that zone are included within the legal 35 mile limit. The latter case is fraught with potential problems—a possibility of law suits from people who are outside the 35 mile limit but are included within a ZIP code which has been identified as having its representative coordinates within the legal exclusion zone (e.g., Subscriber C in Figure 3.1).

Reliability of the provided ZIP code information **is a major weakness** in the use of ZIP codes for determining exclusive blackout areas. The information in the central database may not reflect the actual location of the descrambler. For example, in addition to simple recording mistakes that might not otherwise be caught, there are many cases where the location of the descrambler and billing address are totally different. Examples of this include: some who use their business address for billing even though the descrambler is at their home location; a family that might be paying for service for a relative in another location; and where the person simply moves and doesn't get his mailing address updated.

Another possibility is that of **deliberate deception**, which may be the weakest link in the entire Syndex concept. In order to avoid Syndex blackouts, **a person could simply use a different billing address** such as that of a friend, relative, business, or simply a mailbox service in a remote location. It is highly likely that a subscriber, having knowledge of the possibility of having some of his reception excluded even though he is paying for it, would very likely engage in such deception for this purpose.

There is no reasonable means of verifying that a person has given the correct ZIP code. It is simply beyond the resources of broadcasters and syndicators to physically visit a significant number of descrambler locations to determine whether or not a correct ZIP code has been given. Even if a visit to such a location were to occur, there is no particular reason for the person to cooperate.

In addition to the impossibility of verifying the ZIP code information given by the customer, we must also consider customers who are within a blackout region (e.g., Subscriber A in Figure 3.1) but, whose only option is reception directly from satellites. A demand to be offered service would open an entire new area of concern, that of verifying specific underserved areas within the blackout region. Relative cost for service would become an issue as well in determining if an alternate source was "reasonable."

3.3 Telephone

The C&G paper refers to alternative ways to implement Syndex such as: "possibly by the home telephone area code and exchange (Central Office)." All of the above ZIP code arguments apply equally well to exclusions based upon a person's telephone area code and central office. This would provide a different partitioning of the coverage area, while retaining exactly the same problems as shown for Subscriber B in Figure 3.1. Other means of using the communications capability of the telephone are also impractical. For example, it is not possible to call the descrambler on an ordinary telephone line without special exchange equipment for signalling. Doing so would ring the telephone causing the customer to answer, or trigger some other device such as an answering machine, a modem, or a FAX machine. Thus, no verification of location is possible in this mode.

It is technically possible to force the descrambler (on command) to call an 800 number to attempt to verify its location and status. However, for this to be effective, automatic number identification (ANI) must be available and must be capable of being communicated to the DBS control center. Although the Bell companies claim that they could provide such a service (for a significant fee), a disproportionate number of the satellite receivers are in areas served by the independent telephone industry. This involves a multitude of smaller companies, not all of which have the ability to communicate the necessary ANI information to the DBS control center without investment in new required plant equipment.[1] The first author's considerable experience in the

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1 David A. Woodcock and Larry K. Moreland, "Launching a Statewide ANI Passing Impulse PPV System," NCTA Technical Papers, 1988, p. 4.

development of telephone switching and transmission systems leads to doubts that this could be implemented effectively on a nationwide basis except with an unacceptable cost.

Response through the telephone line has other complications such as what to do if the telephone line is in use at the time a response is required. This adds an additional burden on the software for retries. Also, the cost of the long distance calls must be considered. An additional problem is that there may not even be a telephone available.

The result of these two considerations, ZIP code and telephone area code and central office, is that effective VideoCipher Syndex implementation, based on either ZIP code or telephone enquiry, is totally impractical. **It can very easily be defeated non-technically by the provision of wrong information.**

3.4 Acquisition Time

VideoCipher II has a very limited blackout capability. When a HSD (Home Satellite Dish) subscriber requests service, his descrambler is assigned a coordinate location based on the Post Office location corresponding to the subscriber's ZIP code. When initially authorizing the descrambler, the VideoCipher II system transmits that descrambler's coordinate location over the satellite channel to the descrambler for future use. If a particular program is to be blacked out using VC-II, the program supplier would be able to define up to 32 blackout regions in the U.S.,[1,2,3] specifying the center and radius of a circle for each region. Each descrambler, after receiving the blackout region information, would compute whether it is outside of all blackout regions, and if so, would allow viewing of the program.

One problem with this procedure is that it all takes time. Each time the user tunes to a particular channel, **he must wait for the descrambler to receive the entire list of blackout areas** and make sure he is not in any of these areas before allowing the viewer access to the program. It becomes clear that longer acquisition times would result from lists containing more blackout regions.

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1 M. F. Medress, "Satellite Television Scrambling with VideoCipher", IEEE Trans. on Communications Technology, September 1985, p 82.

2 M. F. Medress, "How Will VideoCipher Affect the TVRO Picture?", TVRO Technology, October 1985, p 20.

3 Affidavit of Dr. Jerrold Heller, July 28, 1989, attachment to "Comments of General Instrument Corporation", filed with the FCC in the matter of: "Imposing Syndicated Exclusivity Requirements on Satellite Delivery of Television Broadcast Signals to Home Satellite Earth Station Receivers." FCC Gen. Docket No. 89-89.

A full complement of 32 blackout areas requires a minimum of approximately **seven seconds**[1] for each channel for the receiver to make the check, assuming that no channel errors occurred. The presence of channel errors will cause a repeat of that cycle with the attendant increase in the access time. This was the method suggested by the C&G paper for implementing their "Phase I" of VC-II implementation of Syndex. This additional period for checking the blackout list could be perceived by a subscriber as being a considerably longer period.

Subscriber viewing habits today are such that channel flipping via the remote control is very common. While there is an obvious delay in selecting channels at different orbital locations, the subscriber will very definitely find the delay period within collocated channels to be excessive and aggravating. This process will cause a considerable decrease in subscribers' perceived value of the service, definitely harming the satellite broadcasting business.

The Commission must understand that this delay will be incurred by the vast number of subscribers outside the blackout area. Although the vast majority of satellite subscribers are in areas outside of the protected areas, **they would be forced to put up with the nuisance of excessive acquisition delays** whenever Syndex is invoked for the much smaller number of subscribers. Therefore, we believe that the use of this capability of the VideoCipher II is not a feasible means for implementing the more general requirements of Syndex.

The more extensive Syndex "Phase II" implementation, suggested by the C&G paper, **would increase the acquisition time many fold**, and would further worsen the multi-region capability. The subscriber still must wait for transmission of the entire list of excluded areas before the earliest authorization receiving can begin. The longer list could take several minutes due to occurrence of additional errors over the longer interval. In this case, **all viewers would be severely penalized in order to exclude a few**. This is discussed more fully in section 4.3.

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1 Jerrold Heller Affidavit, September 19 1989 Reply Comments of General Instrument Corp. In the Matter of Imposing Syndicated Exclusivity Requirements on Satellite Delivery of Television Broadcast Signals to Home Satellite Earth Station Receivers. FCC Gen. Docket No. 89-89.

4.0 Syndex and the VC II+

4.1 Theft of Service and Introduction of VC II+

The greatest problem currently facing the satellite broadcasting industry is that of signal piracy—the deliberate reception of signals for which the viewer has not paid. The purpose of VideoCipher was to prevent unauthorized access to these signals. Unfortunately, an unforeseen breach in the physical security of these devices has allowed potentially as many as half of the 1.1 million operating VideoCipher units to be modified for "pirate" decoding.[1] As a part of the satellite industry's ongoing effort to control signal theft, General Instrument will soon introduce the VideoCipher II Plus (VC II+). For reasons set forth hereinafter, implementation of Syndex with the VC II+ is not feasible.

The General Instrument program to implement this improved protection is already well under way and actual implementation will begin in late September, 1989. **By no later than the end of 1989, all new production of VideoCipher will be VideoCipher II Plus units.**[2] **At that time VideoCipher II production will terminate.** An upgrade for existing units will be offered, but it is important to note **this plan is purely voluntary.** The C&G paper is predicated upon these upgrades. We are unaware of any existing means to force any newer units upon the one million or so users of VideoCipher (legitimate and otherwise) currently in use. This means that the continuing authorization of legitimate units will also be authorizing pirate units for the indefinite future.

4.2 Cost and Schedule

A basic tenet of the C&G paper is that Syndex implementation can be piggybacked onto the already-under-way VideoCipher II Plus program , causing no additional delays in the program and adding virtually no incremental cost. As we shall see, **this supposition is totally erroneous** and, as a result, their conclusions as to the schedule and economic feasibility of VideoCipher Syndex are totally fallacious.

4.2.1 Project Schedule

Based on the extensive design and implementation experience of the authors, a sample project plan for a VC-II Syndex upgrade has been devised, based on necessary steps. A project planning

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1 SBCA Pleading filed with the FCC on this same matter.

2 Reply Comments of General Instrument Corp. In the Matter of Imposing Syndicated Exclusivity Requirements on Satellite Delivery of Television Broadcast Signals to Home Satellite Earth Station Receivers. FCC Gen. Docket No. 89-89.

chart is shown in Figure 4.1. The corresponding task time-line chart is shown in Figure 4.2. Each box shows the earliest start date and the working-days duration of the task. For purpose of estimation, it is postulated that an FCC decision to implement Syndex occurs in January 1989.

Only one month is allowed for planning and collection of necessary resources. Given that financing is approved, employees with adequate capabilities and facilities first must be identified and made available. A very short period of a month and a half is allowed for System Engineering and specifications. About three months are estimated for design of hardware and software modifications in the scramblers and descramblers; **none** for LSI modification (more on that later); two months for prototyping and hardware-software integration; two weeks for lab testing of combined scramblers and descramblers; and two and a half months for field testing in a real operating environment. Such tests are required for at least that long to produce confidence in results and shake out any potential problems that might relate to the monthly descrambler updating cycles.

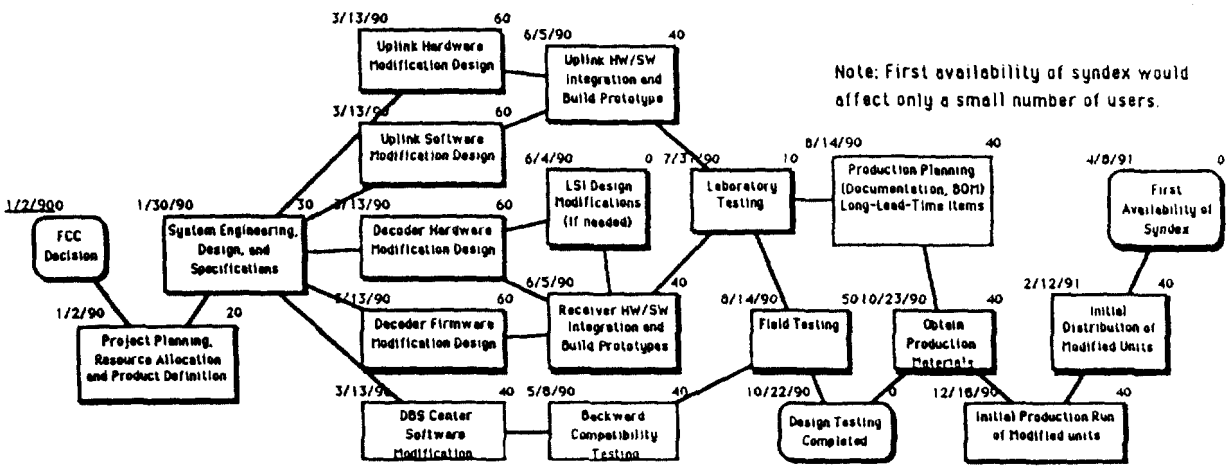

Figure 4.1 Project Task-Time-Dependency Chart

Assuming a successful field trial, preparation for production can then commence. Less than two months are allowed for obtaining production components. It is assumed that GIC is willing to take risks by ordering long-lead-time components earlier, which involve custom production, such as the highly-protected secure chips. Two months are allowed for the first production run and testing, and an additional two months for distribution before even a small quantity of modified descramblers would be available for Syndex. No slack is allowed, and perfect progress through all stages is assumed. As can be seen, **this very optimistic, no-problems, critical-path schedule places the earliest implementation of full Syndex capability in new units to April 1991—a full year later than the schedule suggested by the C&G paper.**

The C&G paper assumes that additional data capacity is available for transmitting exclusion lists, **but it is not**. Any additional data transmission capacity was provided for new subscriber data

services. Therefore, it is almost certainly stripped by circuitry and routed directly to an output port of the custom LSI (Large Scale Integrated) chip, rather than being available internally to the processor. Use of this additional capacity for Syndex would likely require rework of a custom LSI chip—**a critical-path task**—which would add at least six months to the schedule. This would push the earliest full Syndex implementation out to October, 1991—**a full year and a half later than the C&G paper's estimate.**

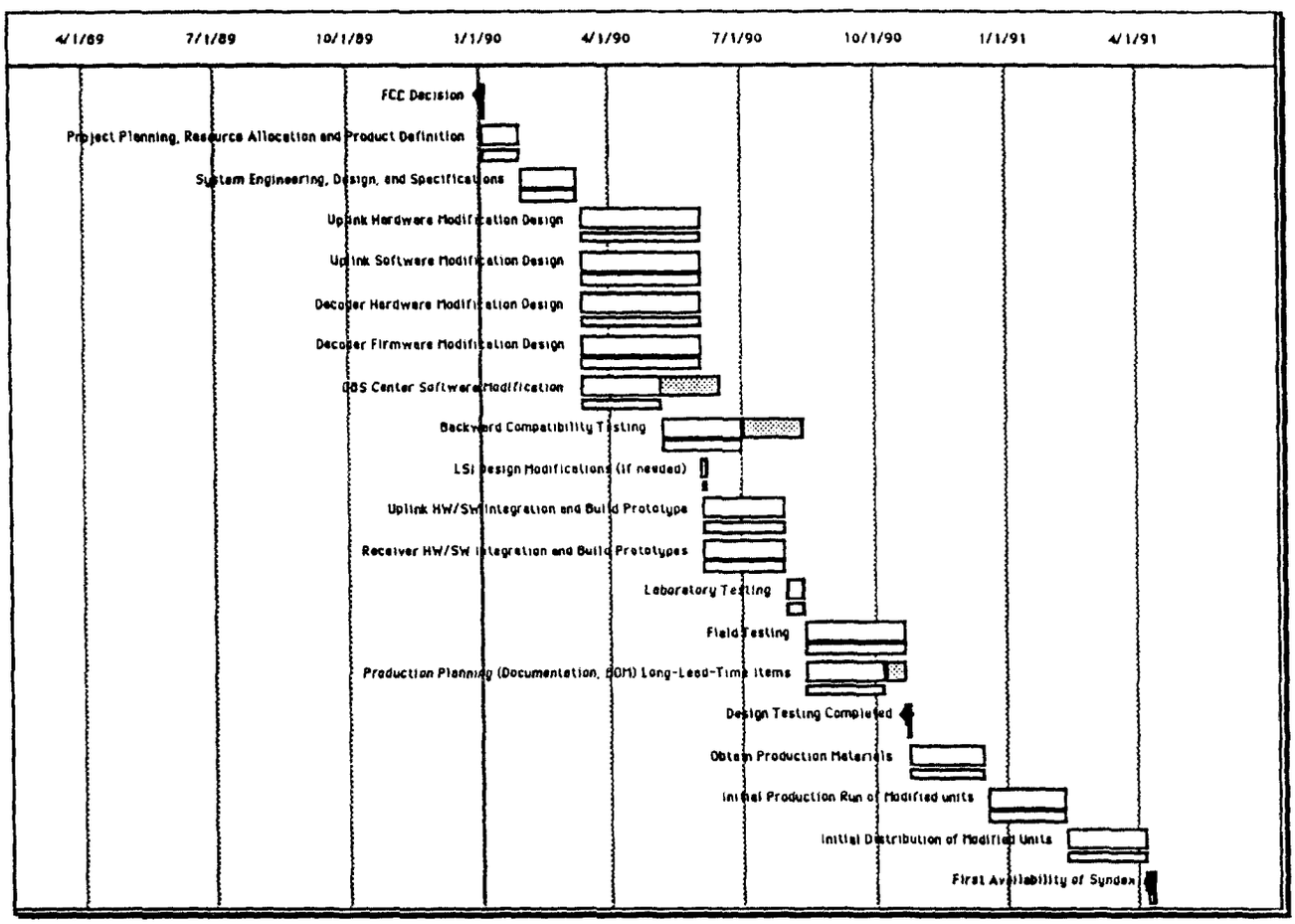

Figure 4.2 Top Level Time-Line Chart

The current VideoCipher II Plus program is already in the field testing stage. **Therefore, requiring the VideoCipher II+ to be modified to implement Syndex would cause a delay of a year or more in making available this desperately-needed anti-piracy program—clearly unacceptable.**

Another significant point is that **conversion to the VideoCipher II Plus is totally voluntary.** The question of how the Commission can force modification of existing VC II units is unclear. It must be assumed that the million or so existing units today, plus new sales of current inventory, plus all additional sales to at least 1991, will have neither the improved security nor Syndex capabilities,

and so **would be more valuable than the upgraded units.** Delays due to Syndex upgrades would further exacerbate the problem.

A combination of forced delays in production of VideoCipher II+ and a possible sales rush by new subscribers to beat Syndex **could cause a severe shortage of descramblers.** The HSD industry already has suffered once due to such a shortage and would strongly oppose any repeat due to Syndex implementation. Because General Instrument will be switching production to the VideoCipher II Plus very shortly, flushing the inventory pipeline by April 1990,[1] the supplier pipeline for components for the older VideoCipher II has certainly already been interrupted. Because of the custom proprietary nature of many of these components, especially the secure ones containing crypto keys, they are not available "off-the-shelf" and require long lead times to schedule restart of production. For these reasons, it is imperative that Syndex not be forced on the VideoCipher II Plus.

4.2.2 Descrambler Modification Costs

The schedule issue is a compelling enough reason not to force Syndex on VideoCipher II Plus. However, without the concurrent implementation schedule of VC-II+ and Syndex, the C&G paper's "cheap Syndex" house of cards collapses. The implementation of a separate Syndex upgrade must be examined under the full weight of its **actual** cost.

The descrambler ROMs (Read Only Memories) must definitely be changed and may even have to be expanded, requiring additional hardware and a circuit board re-layout. The processor memory (RAM) would very likely need to be expanded. We have already seen that some custom LSI would need to be replaced. This means that the entire VideoCipher II module within the subscriber's satellite receiver must be replaced with a new, more expensive unit. Based on the current price of the VC II module (present dealer price is $239.[2]), it is estimated that a new, **full Syndex module would cost at least $200.**

Assuming a modicum of cooperation from subscribers, service personnel must be dispatched to effect the VideoCipher transplant. This would be an expensive operation because a large number of these units reside in rural areas. Service charges for these types of calls can be estimated at $50 with $100 more likely for rural areas. Therefore, the **per-unit Syndex upgrade cost** (for which the

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1 Reply Comments of General Instrument Corp. In the Matter of Imposing Syndicated Exclusivity Requirements on Satellite Delivery of Television Broadcast Signals to Home Satellite Earth Station Receivers. FCC Gen. Docket No. 89-89.

2 Documented in SBCA's reply comments filed in this proceedings.

customer receives less) is **at least $250**—a far cry from the $5 range "piggyback fee" stated by the C&G paper.

Assuming that today's number of legitimate units in the U.S. (approximately half of 1.1 million) grows over the next twenty months at the current rate of about 25,000/mo. to over one million by the time a Syndex upgrade program could commence, and assuming full subscriber cooperation, the cost of upgrading units presently in the field (using a conservative unit upgrade cost of $250) would be in the vicinity of **$250,000,000**. To put this in perspective, **this amount could otherwise build, launch, and operate an entire true-DBS (Direct Broadcast Satellite) 16-channel system**, a goal which many would like to see happen soon.

As can be easily seen from Figures 4.1 and 4.2, the true extent of the schedule means that the **non-recurring costs will be at least several times that quoted by the C&G paper**. Additionally, cost will accrue to operate the DBS center and the uplinks, and for the increased billing and administration costs. Personnel training and equipment must also be updated to handle related service issues.

Thus, the overall cost of Syndex is approximately 50 times that estimated in the C&G paper. The big question is: "Who pays?" No logical answer is at hand.

4.3 Blackout Expansion Feasibility

- The C&G paper does not show feasibility of blackout capability expansion in the VideoCipher II system or its enhancements.

The main conclusion of the C&G paper is that, based on a method the paper proposes, the number of blackout regions that can be supported by the VideoCipher II system can be expanded from 32 to about 450 regions. They claim this modification would not require a total system design change or hardware change but only firmware and software modification of the upgraded VideoCipher II Plus.

One of the critical limitations which precludes an implementation of many simultaneous blackout regions is the time delay which each VideoCipher descrambler would experience in determining whether it should be blacked out or whether it should allow viewing of the program.[1]

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1 Affidavit of Dr. Jerrold Heller, July 28, 1989, attachment to "Comments of General Instrument Corporation", filed with the FCC in the matter of: "Imposing Syndicated Exclusivity Requirements on Satellite Delivery of Television Broadcast Signals to Home Satellite Earth Station Receivers." FCC Gen. Docket No. 89-89.