VIDEOTEX ALTERNATIVES IN CABLE

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Introduction

The first videotex alternative determines whether the transmission is broadcast, telephone, or cable. The concentration here is on cable. The reasons for this will be discussed in detail since they are fundamental to understanding cable's substantial advantages over competing media. In cable there are a wide variety of alternatives to consider. Should the videotex service be vertical blanking interval or full field? Will financial support come from advertising or from pay, or both? If a pay structure is chosen will the security be soft, firm or hard? Will the service be tiered and addressable or simply go no-go? Will it be one-way, one-way upgradable, or two-way? Will the display be RF or RGB? Are mosaic graphics adequate, or must geometric graphics be employeed from the very beginning? Plain or fancy?

VBI vs. Full Field

Vertical Blanking Interval (VBI) cable teletext is basically an ancillary service. Like its broadcast cousin, it has limited capability. Unlike the broadcast environment, however, cable has multiple VBI's under the control of the same entity. Thus, tiering can be accomplished by putting information on various subjects on different channels. Cable will not have the multipath problems that broadcast does. The Keyfax service is a right-now example of VBI cable teletext nationally distributed in the Vertical Blanking Interval on Channel 17, WTBS, Atlanta. Keyfax is on exhibit at the convention and equipment is available now on a limited basis. VBI teletext makes the most sense in older cable systems which have 12 to 24 channels and cannot afford a fully dedicated teletext channel. A 12 channel cable system which used its 12 VBI's for separate data services, could offer significantly expanded service without increasing bandwidth. VBI teletext services are available on any systems that carry WTBS, NBC or CBS. Both NBC and CBS are currently broadcasting teletext according to the North American Broadcast Teletext Specification (NABTS). WTBS carries the Keyfax signal which follows the British approach. Unfortunately, two different decoders would be required to receive all three signals. Full field teletext requires the dedication of a complete video channel to the teletext service. In return for this commitment, full field teletext offers tremendous page capacity. Typical systems can carry 500 or more pages per second. This is in contrast to the 4 or 5 pages per second possible in a VBI service. Thus, for a given 10-second maximum wait time, full field teletext has a capacity of 5,000 pages. This contrasts with a 40 or 50 page capacity for a 10-second wait in a VBI system. Two examples of full field teletext systems are at the convention. The Time Videotex Information Service (TVIS), is a full featured, high resolution graphics service with the emphasis on quality contents. Zenith has made available a full field tiered addressable teletext set of equipment with the emphasis on lower cost and more immediate availability. The TVIS system has been created by experts in publishing and information communications. The Zenith system has been created by hardware experts.

Advertise or Pay

Two mechanisms of financial support are proposed. Advertiser support is the more conventional method used in broadcast television. Advertisements are introduced either in a intrusive or non-intrusive manner. The intrusive ads are unavoidable. They appear as messages on a page containing desired information. The non-intrusive ads must be specifically pursued. The advantage of a non-intrusive ad is that it serves a cus-

tomer with a serious need. The advantage of a intrusive ad is that it attracts attention.

The alternate method of financial support, is a pay service. This is akin to the method of support employed in premium cable services. In order for a pay strategy to be successful, access must be restricted. There are at least three approaches to restricting access. Soft security relies on the scarcity of equipment to restrict access. This technique has been employed by Keyfax. The advantage is simplicity. The disadvantage is that if teletext becomes successful in the broadcast environment, teletext receivers connected to cable will obtain the Keyfax service for free. This will require a change in the Keyfax support mechanism to an advertiser-based approach or a switch out to different hardware. The Zenith system uses a firm security mechanism which introduces a modest amount of scrambling of the data. A commercially purchased broadcast teletext decoder will not be able to decode the Zenith scrambled signal. The ultimate in security and cost is a hard scrambled system based on advanced digital techniques, such as the Digital Encryption Standard, created by the National Bureau of Standards. Soft security has a limited lifetime. One of the principle disadvantages of soft security in a pay system is the fact that stealing the box is very rewarding. It provides free service for the length of time the information provider avoids Chapter 11. Firm security is an economic compromise which restricts access but avoids the cost of true hard security.

Tiered Addressable

The tiered addressable concept is a fundamental lesson learned by the cable industry in recent years. If a service is valuable, it must be controlled by an addressable product; that is, it must be possible to reconfigure the service in the customers home via remote signaling from the cable headend. A valuable service with a large number of options invites the subscriber to change his mind and try different flavors. Eventually, the subscriber tailors the service to his specific needs. In the meanwhile, considerable changes in the service configuration are required. With an addressable product, this represents only a modest operational burden. That burden is justified once the subscriber finds the services that suit his needs. Without addressability, there is a need to visit the subscriber's home each time he wishes to change the configuration of services. This quickly becomes economically untenable. Tiering is the process of dividing the service into segments. Tiering is merely the application of the market segmentation principle. It allows the subscriber to tailor the service to his individual tastes and needs.

The Graphics Choice

The TVIS full field teletext service and the NBC and CBS Vertical Blanking Interval services are based on geometric graphics. High resolution displays provide eye appeal which is felt necessary, particularly in advertiser supported systems. The Keyfax and Zenith systems are mosaic graphics based. Arguments over the relative costs and relative desirability of different graphic systems, have been carried out in the literature and at conferences over the last several years. There is no need to repeat any of that here. The passage of time will determine which approach survives. It is conceivable that the marketplace has room for both.

NTSC vs. RGB Display

Two mechanisms for displaying the teletext information are possible. One mechanism connects the decoder to the antenna terminals of a television set. The other uses a specially modified television set or a video monitor. The latter approach, while more expensive, yields a better display because the red, blue and green guns of the picture tube can be driven directly. The quality of this RGB drive is limited only by the characteristics of the picture tube. Going through the antenna terminals of a television set enforces all of the compromises made in creating the compatible NTSC color television system. The recent availability of video monitors with RGB inputs has been stimulated by the personal computer. The rapid growth of that market and the prolification of RGB monitors, means that better teletext service will be possible on cable with leased equipment. Teletext modules leased by cable companies will likely have both RF and RGB outputs. The subscriber with an RGB monitor will be able to enjoy higher quality displays without the need of buying a new television set which has the teletext decoder built in. The limitations on the antenna terminal connected display are fundamental to the NTSC color television system. Improvements in future color television receivers will not result in significantly better teletext displays, as long as the connection is through the antenna terminals.

One-Way vs. Two-Way

Nearly all cable systems in the United States are one-way. A small fraction of cable systems are capable of being converted to two-way and an even smaller fraction, less than one percent, are operational two-way systems. Fortunately, one-way teletext has a tremendous potential for providing a useful and interesting service. This is particularly true of full field teletext where the numbers of pages are substantial. A bridge between one-way and two-way and a significant enhancement to teletext is telesoftware. With telesoftware computer programs are down loaded into resident personal computers. The subscriber then interacts with the computer program. A one-way system has thus been given interactive capability. Of course, what is still missing is transactional capability; that is, the potential for placing orders and sending information back to the cable headend. Temporarily, much of that need could be served by touch tone telephone key pads. As impulse pay-per-view becomes practial from a technical standpoint, (and an economic standpoint), the same ten-key pad used for impulse pay-per-view can service the need to communicate numerical data to the headend. Thus, a two-way system can be assembled from a fundamentally one-way teletext service and the hardware required for impulse pay-per-view. This will be an evolutionary process where the hardware develops overtime and bridges are built between systems motivated by entirely different needs.

Plain vs. Fancy

The telephone industry has an expression for its basic service - POTS, which stands for Plain Old Telephone Service. We can borrow that term and apply it to teletext. The issue then is Plain Old Teletext vs. Fancy. Very little imagination is required to fancy up the teletext system and obtain truly attractive results. An example of such interesting features is found in the Zenith full field tiered addressable system. Each decoder is capable of responding to a specific page number that all other decoders ignore. This permits the implementation of an electronic mail system. Messages can be sent to an individual decoder carrying subscribers specific information. Examples of information which serve the cable company's needs are billing status reports and messages about new services. In addition to individually addressed pages, group pages are possible. Thus, the cable company can send marketing messages to all subscribers of a given category. Likewise electronic newsletters for specific groups of individuals can be transmitted.

Some Fundamentals

With all the enthusiasm over videotex, it is well to go back to fundamentals from time to time to reestablish a sense of reality. Any videotex service will require (a) an interesting information base, (b) an information provider (c) a manufacturer or origination and transmission equipment, (d) a one-way or two-way transmission medium, (e) a manufacturer of receiving equipment, (f) sales (or leasing) and service organizations for the receiving equipment, (g) willing buyers (or lessors) of the receiving equipment who are also interested in and willing and able to pay for the information, (h) vast pools of capital held by knowledgeable and willing investors who are capable of evaluating the risks and potential rewards of this enterprise, (i) a business plan which convincingly demonstrates that it will work (not just technically), and (j) leadership to make it happen.

While this list seems detailed, it is in actuality cursory. For example, item (e) the receiving equipment manufacturer, is highly dependent on a manufacturer of Integrated Circuits (IC's). These plastic encapsulated, quarter-inch-on-a-side wafers of highly processed silicon make it possible to do the eletronic magic which puts the "video" into "videotex." These IC's contain tens of thousands of transistors each. Depending on which videotex system is under consideration, the number of these IC's can vary from three or four to dozens. Clearly, it takes many person years to design circuits involving tens of thousands of transistors. The usual Alice-In-Wonderland assumption is that it will just happen. This is due to the phenomena of Digital Mania. The mind infected with this malady believes that anything can be done digitally and in three years it will be free. Furthermore, believing will make it so. Digital watches and calculators are the usual "proof" offered for these beliefs.

Entrepreneurial Factors

The entrepreneurial factors, (h), (i), and (j) are the most commonly neglected in any analysis of videotex scenarios. Yet, they influence every step along the way. The most important

missing element is the confidence that the end user will perceive a value which is commensurate with his costs. The uncertainty in the estimates of these costs is a serious problem contributing to a lack of confidence. The cost components include receiving equipment price or lease costs, media usage fees, and information prices. The value side of the equation, that is, the benefit or utility offered by videotex is even harder to measure or estimate. The components of utility are the entertainment, the cost savings, and the opportunities created by the information brought via videotex. Until the entrepreneurs are confident that this cost:perceived value equation is balanced, they will not proceed. They won't create the scenarios and exercise the leadership which will tap the pools of capital so necessary to provide the required investments. Certainly, the high cost of money (interest rates) adds to the risk.

Broadcast Teletext

World-wide, the most successful videotex service at the present time is broadcast teletext. Specifically, the mullard chip set is employed in about two million teletext receivers. One could naturally assume that this means that broadcast teletext will be most likely to lead the videotex race in U.S.A. There are several major differences between the U.S. and the European experience which may invalidate this assumption.

Firstly, the signal environment in the U.S. is much less hospitable than in Europe. Rather than two or three programs with a thousand repeaters, there are a thousand stations with almost no repeaters. This translates into a situation in the U.S. where nearly everyone receives several low quality signals and maybe one or possibly two quality signals. This is instead of the European situation where almost everyone is in a quality signal environment. The signal quality impairments include low signal levels, co-channel and strong adjacent channel interference, multipath (or ghosting) distortion and a wide range of transmitter and broadcast antenna quality and condition. Receiving antenna problems still further complicate the issue. Since much of the U.S. programming takes place on VHF, antennas must be much larger for the same amount of directivity. Conversely, the same number of "pounds of iron" will yield a less directive antenna with VHF when compared to UHF reception. This lack of directivity is most harmful in high multipath situations, such as large cities. The average quality of antenna installation is lower in the U.S. This is due to the relatively low cost of television receivers. An installed quality UHF/VHF antenna and downlead could easily exceed half the cost of the color receiver. In Europe, where receivers have been relatively more expensive the cost of a quality UHF antenna installation is a modest percentage of the receiver price and a prudent investment at that.

The most difficult signal parameter impairment to deal with is multipath or ghosting. Weak signals are relatively easily handled by the digital nature of teletext. The second most serious threat is impulse noise. U.S. standards for motor brush noise and ignition noise are much less stringent than in Europe. And motors and gas engines are in countless electric home and garden appliances. Anyone with a teenage daughter who has a hair dryer can well appreciate this.

Experience has shown that even the inherently more rugged defined format teletext system used in most European teletext receivers experiences difficulty in the broadcast environment of the U.S. This situation would be even more difficult using the variable format schemes also proposed in the U.S. Proposals have been made for error detection methods to patch over these deficiencies. However, these proposals require the addition of more overhead data bits which further reduce the information carrying capacity of an already limited system.

The visibility of retrace lines on color TV receiver models in current production, limit the number of Vertical Blanking Interval (VBI) lines available in the broadcast teletext service to a precious few. The consequence of this is a no-win choice between limited information presented with modest waiting times and adequate amounts of information with mind numbing delays. High resolution graphics techniques such as Picture Descriptor Instructions (PDI's) aggravate the situation by increasing the transmission time per page while increasing the vulnerability to error. This was well demonstrated in the Washington D.C. trials over station WETA. Error protection adds cost and transmission delay. It further presents an unhappy choice: a) wait until all data has been correctly received before

creating a picture, or b) paint the picture in steps with interspersed delays until it is complete. The waits in a noisy or distorted signal environment can be severe. A note here about "microprocessor-based" systems is in order. Since microprocessors have limited speed, the data must be sent in bursts so they can be digested before display. Since PDI's must be sequentially painted on the screen (i.e., loaded into the bit plane memory) a missed segment causes a delay for a full transmission cycle until the missed segment can be correctly executed. The alternative is complete buffering of the data.

The above discussion implies that the broadcast teletext service in the U.S. must be inherently limited -- much more limited if extensive high resolution graphics are employed. The cost situation further unbalances the "cost:perceived value equation". Even if the teletext decoder were free, the added cost of a quality antenna installation itself may exceed the perceived value of such a limited service. And, of course, the teletext decoder is not free. Depending on the system chosen, the decoder can be very expensive indeed.

If this wasn't enough, the standards issue is yet one more problem. The usual U.S. standards setting mechanism has failed. Customarily, the Electronic Industries Association (EIA) proposes a standard to the Federal Communications Commission (FCC) which studies, modifies and approves it as the law of the land. This failure is probably because the standard questions involved are too complex for committee decision. In fact, most of the controversy in th EIA Teletext Committee has been over issues of marketplace desire. What are the relative tradeoffs between graphics resolution, cost and waiting time? It may be wiser in issues as complex as this to let the marketplace choose between several choices than to pick between just two choices: a) the committee's guess, and b) rejection of the whole idea. In either case, it will be a marketplace decision. In the first case the market has multiple choices, in the latter, just two: "yes" or "no".

Telephone Interactive Videotex

The principal inhibiting factor with telephone-based, two-way interactive videotex is that the medium over which the message itself travels has a usage cost associated with it. To use the telephone terminology, the Public Switched Network (PSN) is rapidly going to Universal Measured Service (UMS). There is good reason to fear that the usage cost will absorb most of the available disposable consumer income. This will leave little if anything for the receiving equipment lease fee, the information purchase, and the share of the originating equipment. Information providers believe they're going to get the usual cable TV revenue split, the cost of telephone interactive videotex will be prohibitive. Another difficulty is in the nature of the PSN itself. The architecture of the PSN is statistically designed based on certain assumptions as to number of calls and length of calls, i.e., hold times. The hold time statistics are likely to be significantly upset by interactive videotex. The success of interactive telephone videotex may be self-limiting by the problems it can cause on the PSN. Longer times until dial tone, more frequent busy signals, and less availability of the phone for its conventional use are just some of the ramifications.

Another serious concern with two-way videotex is that the cost of computer facilities on a per user basis may be a substantial percentage of the total cost. In sharp contrast to broadcast teletext where origination hardware cost is the same for one user as millions, subscriber growth for telephone interactive videotex necessitates origination computer growth.

The two principal advantages of two-way interactive telephone-based videotex as compared to broadcast teletext are: a) access to a much larger data base, and b) transactional services, such as shopping, banking, and electronic mail. As will be discussed below, a much more cost effective means of transporting larger volumes of information is one-way, full field cable television. The second advantage listed above brings serious concerns about security, privacy, and the interface to other computers.

One Way Cable Teletext

Probably the most promising videotex technology in the U.S.A. today is one-way cable TV teletext. The reasons are:

a) no multipath or ghost problems,

b) significantly better overall signal quality,

c) spectrum availability for full-field use,

d) the ability to limit access and thus charge for the service,

e) the ability to segment the market through tiered addressable services,

f) one-way electronic mail with firm security thru addressability,

g) a preselected market of video-oriented potential customers,

h) a market already accustomed to receiving equipment leasing,

i) the relative unimportance of standards,

j) the future upgradeability to two-way interactive services,

k) the present ability to do a hybrid two-way thru telephone "ten-key" requests.

More than half of television households are passed by Cable TV in the U.S.A. More than half of these subscribe. Thus, about 30% or 28 million subscribers now have cable. And the growth rate is aggressive.

The new modern cable systems provide excellent signal quality on from thirty-five to sixty channels. Currently, 440 MHz dual cable systems are being installed in major markets providing a total of 120 television channels. Both signal quality and spectrum availability disappear as issues in these cases. Thus, not only are the 120 VBI's at the cable operator's disposal, but he can partition them according to his needs. In the broadcast arena this is not possible because of the difficulty of orchestrating the level of co-operation between the various owners of the VBI's in a given market and the anti-trust legal questions.

The most exciting cable opportunity is a full field, tiered addressable service. Rather than just four to eight lines in the VBI, over 500 are available. This yields a page rate of over 500 per second. This can be combined with cable's addressing techniques so that each box can be controlled from the cable headend. Furthermore, the service can be partitioned into separate services each of which can have individual subscriptions. Thus, the subscriber can choose between various teletext magazines covering general news, sports, financial, entertainment, etc. He can select and pay for only the services he desires. The addressable nature of the product allows control of reception from the headend. Thus, even if the subscriber frequently changes his mind, his receiving equipment can be reconfigured to match his changing tastes.

The cable subscriber is already accustomed to monthly bills for service and equipment leasing. The teletext service is thus incremental. It does not require the subscriber to adopt a new way of thinking about the service.

An interesting by-product of addressability is being able to send individual pages to each subscriber. This is possible even though the cable system is not a switched network. Electronic mail distribution is thus possible in even a one-way system. The first application is subscriber notification of billing and account status. This can be extended to include "telegram" like service where the messages are phoned into the cable company and then sent to the individual teletext receivers.

Since each cable system is a universe unto itself, the need for national standards is obviated. The digital nature of videotex facilitates translation of information between various protocols.

The one-way cable system can begin to have some two-way capability through the use of the touch tone telephone keypad and appropriate computer interfacing at the cable headend. Thus, an even larger data base can be available with two kinds of pages: a) those that normally reside on the teletext repeating cycle, and b) those that get requested individually. A statistical tabulation can be used to decide when to convert type "b" pages to type "a" pages and vice versa.

Two-Way Interactive Videotex and Cable

In addition to cable's advantages listed above, cable has the promise of two-way. This promise is realized in less than 1% of U.S. cable systems at present. Significant technical, operational, and economic difficulties remain. However, true two-way is a promise broadcast can't even contemplate.

Cable's two-way is not a switched system as is the telephone network. However, electronic message switching

schemes accomplish the same result at much less hardware cost at the expense of bandwidth. But bandwidth is cable's principle available resource. Because of the bandwidth, usage sensitive pricing will not be necessary for the foreseeable future.

The telephone disadvantages with regard to origination computers apply to cable as well with one important difference. Since cable videotex will have an integral one-way teletext service, the quantity of two-way pages can be significantly less. These would be limited to only the less popular pages. The tens of thousands of more popular pages would be delivered via one-way.

It is important to keep a realistic view of cable two-way. It is not a present reality. It now exists only as either a very limited non-videotex-compatible service or as a field trial.

Conclusion

The creator of a videotex system for cable has many alternatives to choose from. This makes the task interesting. Several examples of cable videotex systems exist now and the cable community should study the differences. Cable videotex is imminent and the time to learn about the choices is now.

The good news this paper tries to convey to its audience is that videotex is most naturally a cable service. Cable has a number of significant advantages over rival media such as broadcast and telephone.