DOWNLOADING AND ADDRESSING VIA TELETEXT

Gary W. Stanton

Southern Satellite Systems

ABSTRACT

A teletext signal has been continuously transmitted on the vertical interval of Satcom I, transponder 6 since the NCTA show in 1980. The original purpose was the video dissemination of cable news services. Recently, the system has been modified to incorporate data transmission which emulates a standard telephone line, but with far higher data reliability. In addition, the modified teletext system for data transmission incorporates an addressability function with over five million addresses possible. A priority scheme for national, regional, local and individual addressing is described. A description of the system, including data from reliability tests is presented. This will also define several key technical requirements for successful teletext data reception.

General Information

The cable and communications trades have been full of news about the up and coming information invasion of the home. With the British, the French and the Canadians, among others, the battle lines have been drawn about whose system is the best for delivering various videotext or teletext services into America's wired cable homes. Unfortunately, there's so much talk and so little really happening that it may be time to sit back and take a look at where this revolution really is, what's really happening and what's just in the testing, a few years down the road.

One problem in all the talk is the fact that the generic jargon of the alphanumeric information industry is confusing. Are videotext and teletext the same thing? What about viewdata? And why do some people leave the "t" off of videotex(t)? Do they have lazy typewriters, or not a large enough supply of "t's" at their printer? These questions aside, let's deal with what's really happening.

There are some cable systems in the U.S. delivering "videotext," which for the purposes of this paper will be considered two-way and interactive. There are some broadcast stations test marketing their "teletext" services, which in this article will mean strictly one-way. UPI, Reuters, Dow Jones, and Quotrader are all delivering their services, which are "teletext", to cable systems, today and in the case of Quotrader, to private users. UPI and Reuters began satellite testing of the service in July 1980, and service to cable TV headends in October 1980.

But one-way teletext services aren't really what all the excitement is about. It's the interactive services that are getting all the attention, and precipitating the hue and cry of the future of communications. The Warner-Qube system in Columbus, and other such ventures like The Source in Virginia, are the kinds of things that the cable and communications industry have been talking about so much.

Unfortunately, few of the things being talked about are ready to happen on a national basis today. That's why, if teletext isn't going to remain a thing of the future, the industry needs to use what's available today to its full capacity. That means using the existing means of teletext, one-way delivery, and make it two-way, in effect, by using telephone lines as the means of "upstreaming."

Videotext is basically two-way communications, using a telephone line to "call up" specific information, which is then delivered to the person who

requested it, using the same phone line. It's "narrow stream," two-way delivery, which is interactive.

Teletext, on the other hand, is a one-way "stream" of information (channels or pages), delivered as a "wide stream." Phone lines, the standard means of most operating text delivery today, do not permit wide streams of information, whereas broadcast or cable delivered teletext does. Two-way videotext is selective and slow. One-way teletext is non-selective and fast. It takes a lot of transmission space to provide streams of information for the general public. Because of the various limitations inherent in both videotext and teletext, there is need for both wide stream teletext, as well as interactive videotext.

The major drawbacks to interactive videotext services are the long distance phone charges, the cost of the receive equipment, and the fee for the information service itself. The downloading scenario outlined previously enables users to accomplish most of the same things they could accomplish using a two-way system, for less cost. Downloading with satellite delivered teletext information, as done by CableText, and upstreaming via phone lines means teletext for specialty users is not a thing of the future. It's being done today and can be done by any kind of information supplier who wishes to do so.

In this application, subscribers will be continuously "on-line," with their printer or computer storage device receiving the information transmitted for them.

While a satellite delivered teletext system can be delivering hundreds of different specialized types of information, individual subscribers will receive only the information they want and need, because the teletext decoders will be "addressable." A Teletext decoder will feed the data into a user's printer or computer with storage. Though the information may be delivered at 3 a.m., the user can still "call it up" when he or she is ready to use it, either by instructing the computer to display it, or by simply reading the printed copy. If a subscriber needs to use the information for a transaction, a simple telephone call will make a technically one-way system two-way in effect. Downloading the information via teletext makes the system interactive only when needed, with information being delivered 24 hours per day.

The key to this application of existing, in-use today technology, is in what's called an "RS-232 decoder." RS-232 is an EIA defined standard computer serial data interface used for interconnection of many different devices. A printer or home computer can be attached to a RS-232 decoder, as well as a cable system's character generator as it's being used by UPI, Reuters, Dow Jones, and View Weather today. The delivery of teletext information into businesses and homes of "specialty" users is one of the two markets soon to be tapped by the common carrier Southern Satellite Systems, through its teletext system called CableText.

Let's look at the "downloading" application of teletext. An example is being accomplished today by Quotrader, a commodities service which utilizes a specially equipped computer along with the RS-232 decoder. The decoder interfaces with the microcomputer, feeding the information into the computer for use in analyzing the commodities information. The software provided as part of Quotrader's monthly fee also enables users to receive buying and selling recommendations. Buy/sell orders are placed by a phone call to a user's broker, or by attaching the computer to a modem which permits the user's computer to talk directly to the broker's computer.

That scenario, starting with 1) downloading information into a home computer, or in some cases a printer, 2) storage of the information on the computer storage device or on a printed page, 3) viewing of the information at the convenience of the user, and finally 4) the use of the information for a phone transaction (upstreaming), is one application that is ready for the marketplace today.

Existing System Formats

There are a number of teletext and videotext systems either proposed or in existence in either test or operational modes. Some are very similiar, differing only in minor detail, however, just different enough as to be incompatible. Others are significantly different in one or more respects.

For background purposes, a brief description of the various systems is in order.

1. The first teletext systems and by far the most widely used is the United Kingdom (U.K.) system and its variations. The teletext version is called Ceefax in Great Britain and the videotext version is called Prestal. This system is also used in Australia and several other European countries. Several variations of it are in use in the United States, such as Field Communications' "Keyfax" system and Southern Satellites' "CableText" system. KSL in Salt Lake City and WGN in Chicago also experimented with variations of the U.K. system. Reportedly, 1.5 million LSI chip sets have been sold for the U.K. system.

The U.K. system features a mapped video screen system where each screen alphanumeric character or mosaic graphic character's screen position is defined by its position in the transmit stream. After the necessary page address or header information is transmitted, subsequent consecutive transmissions contain screen row numbers and the information to be displayed on that row. For example, the 10th character transmitted with a row 4 address will be displayed in the 10th screen position in row 4. In practice, it's not quite that simple, but in essence, that is how it works.

2. The remaining major systems use a free format where there is not a fixed relationship between transmit screen positions. This means screen positions must be defined in the transmitted data, as well as line feed/carriage return at the end of each line. The major systems using variations of this protocol are:

a) Antiope: The French teletext system. Technically, Antiope is the screen language and "Didon" is the transmission protocol. The French pioneered the non-mapped concept for teletext/videotext usage.

b) Teledon: The Canadian system. This system is quite similar to the Antiope system, however, it also included a set of picture description instructions (PDI's) which gives the ability to draw circles, lines, and other geometric figures.

c) CBS system: CBS originally adopted the Antiope system to the NTSC television system. They added the necessary transmission protocol to make the system work properly in the 525 line 60 cycle television system currently in use in the U.S.

d) North American Presentation level protocol or "PLP". AT & T combined the Antiope, Teledon, and CBS systems into a single system. The PLP format does not specify transmission format, only presentation level, i.e. viewable level format. This means the CRT and printer presentation codes have been defined by the PLP format, but not the transmission scheme.

Since AT & T conceived the PLP format, Teledon and CBS have ammended their display system protocol to be compatible. At this point there are basically two major competitive incompatible systems in existence, the U.K. system, which includes both teletext and videotext definitions, and the PLP presentation system with the CBS videotext transmission definitions.

Advantages/Disadvantages

Much has been written on the comparative advantages of each system. However, the engineering community must stand back and realize that the end user, whether a home owner, business, or cable system really does not care what technical system is in use. All the end user is really interested in is:

1) Obtaining the desired data or information
2) Reliability
3) Lowest possible cost

It is apparent that each of the two major systems has certain advantages and disadvantages. The particular application should dictate the specific system chosen.

Transparent Data System

SSS has been using an early version of the U.K. teletext system for transmission of the UPI and Reuters news services. There was not a U.K. defined protocol for data transmission only, or for addressability greater than the 800 page numbers defined in the U.K. protocol. Therefore, it was necessary to define a system protocol and have appropriate hardware fabricated.

In the basic U.K. system, a header row is transmitted, which contains the page addresses, various control codes, and 22 free bytes usually used for the first part of the displayed text. Subsequent transmit rows contain the hundreds digit of the page number as the row number and the data for display. All transmit rows have a three byte preface consisting of two bytes of clock run-in and a single byte framing code. These three bytes synchronize the decoder for data recovery. The control and addressing codes in both the header and rows are Hamming code protected, while the data is transmited with odd parity.

Standard Transmission Mode

Examination of the Header row reveals a number of options. The first option is to use the last 22 bytes in the header row for transmission of the required data. To implement this system, the computer needs to store incoming data until 22 bytes are collected, then insert these bytes on the next available vertical interval line. The decoder will receive these 22 bytes and store these in RAM. A microprocessor controlled UART then spools the data out to the RS-232 interface at whatever data rate the UART has been set for. As long as the UART is set to transmit at a speed equal to or greater than the incoming rate for new data, reliable data recovery is obtained.

Since the effective vertical interval transmission speed is 5.554 megabits/second for two or three vertical interval lines, many standard 300 to 1200 baud services can be multiplexed together. The basic U.K. Teletext chip set has capacity for 800 descrete addresses. For practical purposes, one vertical interval line will support forty-four 300 baud services in this mode.

Multiple Transmit Mode

It has been recognized that a need exists for a higher level of data integrity than may exist in a single transmission. In two way telephone line service, the receive device can send a negative acknowledge (NAK) upon failure to receive intelligible data. For one-way transmission this is not the case; therefore, depending on the reliability required, it may be necessary to retransmit the identical block of information.

To implement the multiple transmission mode, two additional control bytes are defined, thereby leaving 20 bytes for information data. The first control byte is a mode definition which alerts the decoder of the multiple transmission mode. The second control byte is a continuity index which is incremented each time new data is sent, but is not incremented on a repeat of the old data.

The decoder is double buffered. In its receive buffer only data with correct parity is retained. Subsequent transmissions will not replace previous correct parity information, but will fill in missing information. Therefore, the data will integrate upward on subsequent transmission. Upon receipt of a new continuity index, the data in the receive buffer is moved to the output buffer for spooling out to the RS-232 interface. The input buffer is cleared for a new block of data.

For ultra high reliability, it is possible to transmit three or more times, with the decoder selecting the best of the transmissions in a voting process.

Additional Addressability

Examination of the control code structures reveals 13 bits that can be redefined without jeapordizing needed control functions. Using these 13 bits a three tier subaddress mode was constructed. The tiers contain 64, 16, and 8 levels, respectively, with each tier operating independently of each other.

For example, the group of 64 can be defined as states, the group of 16 could be regions in a state, and the last tier group as individual decoders within the region. Alternatively, the 8 tier group could be used for regions in the U.S., and work downward in the opposite direction. A third option is to use the bits for discrete decoder address instead of a tier system. This gives a total of 6615 discrete addresses per page, or a total of 5,292,000 discrete possibilities.

The zero address in each tier is not included in the above address possibilities. The zero address is reserved for mass addressing. If a zero address is sent for a given tier address all decoding units in that tier respond to the data in that pocket. This gives the flexibility of mass addressing of decoders without sending identical data to units with different address codes.

Data Error Test

A number of tests have been performed and are continuing to quantitize reliability at a TVRO, and subsequent transmission on a cable system. Although measurements are continuing, various preliminary results are reportable. It is apparent that considerably different factors are involved in cable system data integrity than those which affect TVRO integrity.

At a TVRO, impulse noise appears to be the greatest source of errors. The amount of impulse noise is related to the usual known factors such as dish size, LNA, etc. In other words, the higher the carrier to noise ratio, the better the data integrity. Tests were made using a 3.65 meter dish with a

90 degree LNA, with the measured c/n = 11. Byte error rates of 1×10^{-5} in the dual transmit mode were measured. The dual transmit mode uses the technique described earlier, with two transmissions in the same TV field. Tests with a 10 meter antenna indicate error rates of 1×10^{-6} are obtainable in the single transmit mode.

There are numerous factors that affect performance of teletext via the cable TV medium. A complete analysis is beyond the scope of this paper; however, several comments are in order. One observation is that transmission errors tend to appear in large groups, rather than singularly as is typical at a TVRO. Various investigators have found many causes.

It has been shown that the modulation process is critical in passing teletext data. One study by a reputable manufacturer has concluded that adjustments of modulation levels is of critical importance, as over modulation is disastrous for teletext data recovery.

Conclusion

An economical, addressable, teletext system has been developed for downloading data to various types of home/business data equipment such as computers and printers. The system features transparent data communication as well as a flexible addressable format. The system is based on the reliable and available U.K. teletext chip sets for implementation in today's marketplace, using high speed one way data downloading and low speed selective return path via the existing telephone system.