REPORT:

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AT&T'S PAY-PER-VIEW TELEVISION TRIAL

Introduction

Pay-per-view service is a television entertainment service wherein consumers can watch a scheduled movie or live event on their home television sets and be charged specifically for the viewing. It is a usage-sensitive pricing system for television entertainment similar to the movie services found in some hotels in which viewers pay only for those programs they watch. The prospect of multimillion-dollar revenues from the sale of first-run movies, live sporting events, and other premium television entertainment on a pay-per-view basis has continued to entice movie studios, event producers, cable and network television operators, and other purveyors of home video entertainment. For pay-per-view to be a viable business, an efficient system for ordering, distributing, and billing of the pay-per-view programs is necessary.

Past Approaches. Many approaches to pay-per-view ordering, distribution, and billing have been tried in the past. In recent years, efforts have centered on exploiting the *one-way addressable systems* used by cable companies and in some *television receive-only* (TVRO) satellite antenna systems. In a one-way addressable system, a television channel or group of channels is transmitted enciphered or "scrambled." (See Appendix A.) Descrambling in the addressable converter (the cable box that sits on or near the television set in each consumer's home) can be enabled or disabled by signals transmitted along the cable from the cable *headend* (the central signal source for a cable company).

Although not every cable company uses such equipment, more than 9 million cable households are equipped with one-way addressable converters today and the number is growing steadily. In addition, there is a smaller number of addressable descramblers in homes with TVRO antennas. Some satellite broadcasters may offer pay-per-view programming to these consumers as well, thereby increasing the total number of addressable households by one million or more.

In a typical pay-per-view system, the consumer orders a specific program by placing a telephone call to the local cable company. An attendant then manually enters this into the cable company's business management computer system. Then, the program is transmitted scrambled; descrambling occurs only in the homes of those who ordered that program. Later, the consumer is billed using the cable company's own billing system.

This method has several major limitations. It is costly, because consumers tend to wait to order until a few minutes before the program begins and the resulting high order volume requires many human attendants and service lines. The costs of manual order entry can consume a large fraction of the program revenue, with labor costs particularly high during typical consumer viewing periods (evening, night, and weekend hours). Cable companies often try to discourage last-minute calling by offering incentives for ordering early, but this requires that consumers plan their viewing ahead of time and substantially lowers ordering volume and revenue. Furthermore, attendants are often overwhelmed by the volume of calls

(regardless of the number of attendants), with calls becoming lost and consumers dissatisfied.

Some cable companies have tried to solve these problems using various other technologies, such as automated voice response systems. However, none has been completely satisfactory. Moreover, a local approach means that order-taking effectiveness varies widely. In addition, it rules out nationwide marketing techniques. The pay-per-view industry would like to have an order-taking technology that is standard and consistent throughout the nation.

SHOWTIME®'s Requirements. In early 1985, AT&T and SHOWTIME/THE MOVIE CHANNEL, INC® began discussing the need for a pay-per-view ordering service to complement cable companies' own addressable system distribution channels and billing systems. It was decided that for this market, a pay-per-view ordering mechanism must:

- Be national in scope
- Handle a large volume of last-minute telephone orders to accommodate and benefit from impulsive consumer buying decisions
- Be very simple and easy for consumers to use
- Work with both dial-pulse and touch-tone telephones
- Require no additional hardware in the consumer's home so that cable companies could offer pay-per-view with minimal initial investment and risk
- Be fully automated from end to end including an automated interface with cable companies' business management and billing systems.

The National Ordering System Concept

To respond to this challenge, AT&T proposed a *nationwide order-entry system* for pay-per-view programs using the AT&T public switched network. The national ordering system concept is shown in Figure 1. The order-entry technology is based on the integration of four elements: AT&T 800 service; mass announcement systems within the AT&T network; automatic number identification (ANI); and an order processing system to receive ordering information, activate the addressable system, and handle billing.

AT&T 800 service allows consumers to place toll-free orders. Each available movie or event is assigned a unique toll-free 800 number. To order, the consumer dials the number for that movie or event.

Mass announcement systems within the AT&T network provide quick order confirmation with high traffic capacity. No 800 service access lines, which have led to traffic choking and limited capacity in the past, would be required.

Automatic number identification (ANI) allows AT&T to capture the caller's telephone number. The ANI information is collected and delivered to a national pay-per-view distributor, such as SHOWTIME. Distributing the information to the cable companies is handled using a data subchannel on the same national satellite feed on which the programming is delivered.

An *order processing system* located at the cable company receives ordering information from AT&T and uses it to activate the addressable system as well as the cable company's billing process. Turnkey, fully automatic processing, validation of the order, and activation of the addressable system is achieved by interfacing the ANI data stream from the satellite receiver directly to the cable company's business management processor. This also provides an integral interface to the cable

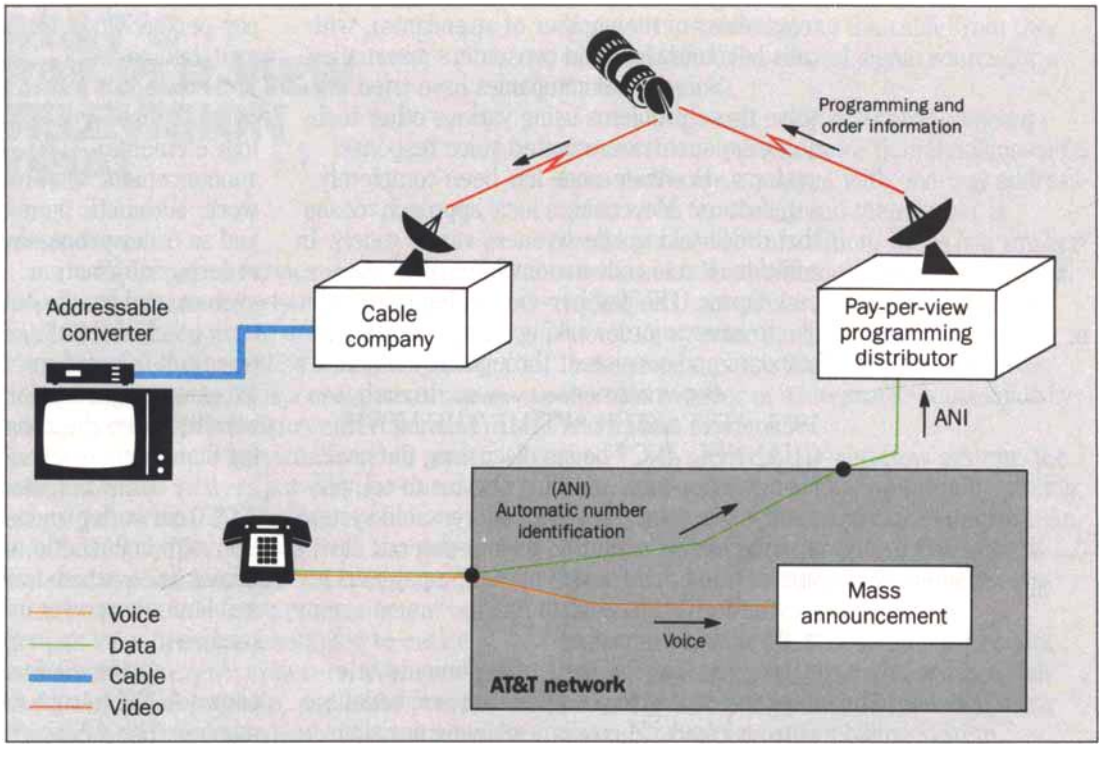


Figure 1. The AT&T national ordering system concept. The trial architecture emulates the concept of a national ordering system but uses existing AT&T network capabilities.

company's billing process. These four components form a complete pay-per-view transaction processing system.

The Trial Decision

Such a system would be unique and such a radical change in the way the cable industry handles pay-per-view that the three companies [AT&T, SHOWTIME, and Viacom International, Inc. (SHOWTIME's parent company)] decided to conduct a marketing trial at one local cable company. The objectives of the trial are to measure consumers' reactions to the system; identify the marketing, technical, operational, and billing issues associated with it; and evaluate the worth of this pay-per-view technology. A contract among the three partners was signed in December 1985. The trial began in Milwaukee, Wisconsin in June 1986 and is scheduled to end on May 15, 1987.

This paper describes the architecture and design of the Milwaukee trial and gives a foretaste of its results.

The Milwaukee Trial

Each of the three companies, AT&T, SHOWTIME, and Viacom, has a major role in the trial. SHOWTIME is furnishing the television programming. The trial uses television programming from VIEWER's CHOICE®,

a satellite-distributed pay-per-view television service launched in November 1985 by SHOWTIME. VIEWER'S CHOICE offers movies and special events to cable companies around the nation for pay-per-view applications. Viacom Cable, a division of Viacom International, Inc., is providing the trial site and is operating the pay-per-view service and marketing it to its subscribers. AT&T is providing the trial order-entry system. In addition, CableData Corporation, a California-based cable business management and billing vendor, has provided the application software at the trial cable company's premises.

Site Selection. The trial site is Viacom Cablevision of Wisconsin, a 36,000 subscriber cable company serving thirteen suburban communities in the Milwaukee area. This cable system has a history of technological innovation. It was the first cable system in the country to use two 400-MHz coaxial cables to allow a full 108-channel capacity. Currently, over 60 of its channels are activated and carry television programming. The system was also one of the first to use Zenith Z-TAC one-way addressable equipment, which employs a particularly secure baseband scrambling technique. Every cable customer on the system is equipped with an addressable converter and can order pay-per-view movies and events during the trial.

This site was chosen for a number of reasons:

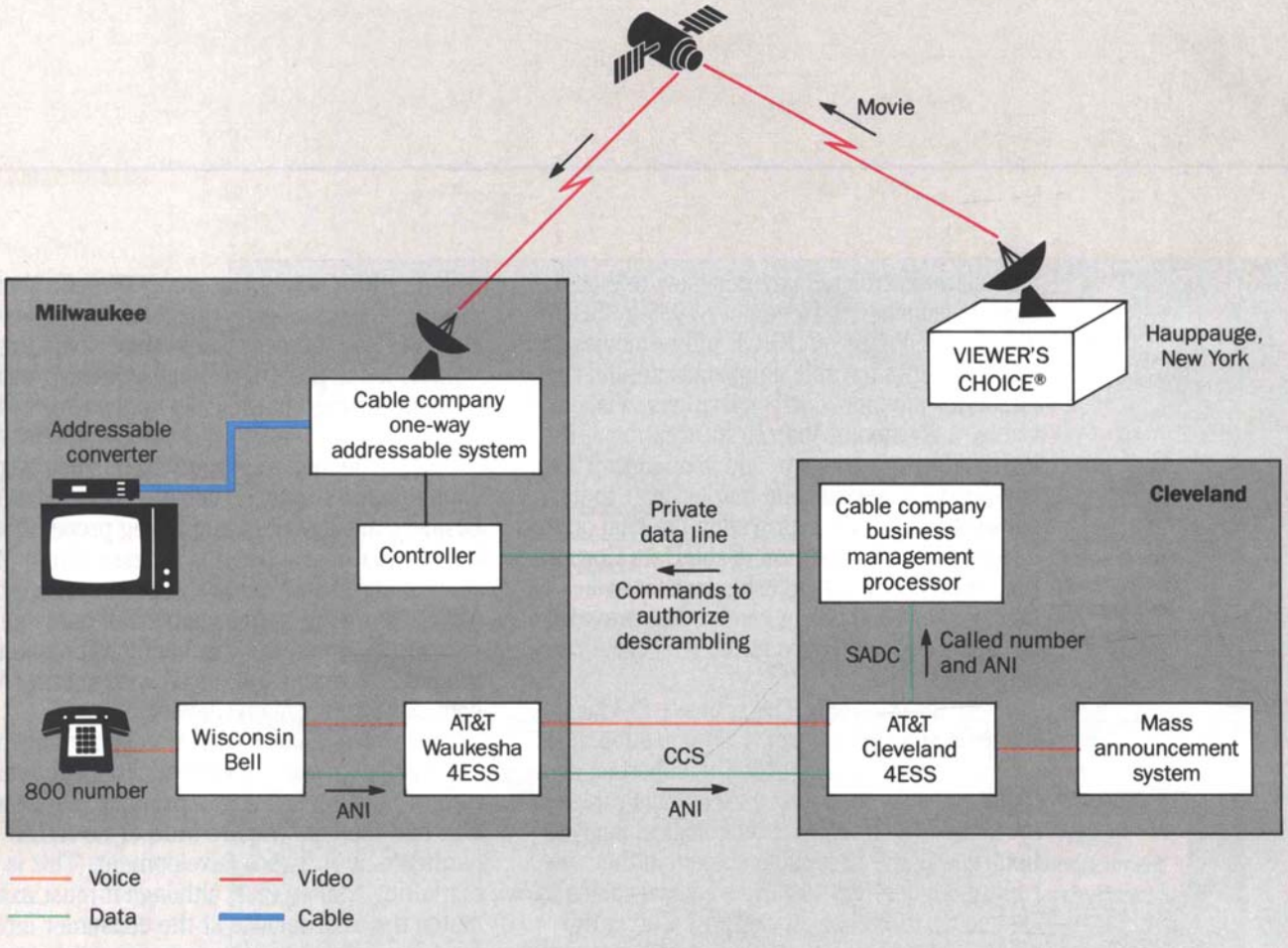
- The customer demographics are typical of cable customers nationwide.
- Every customer has an addressable converter.
- The system is large but manageable in size.
- It is served by the appropriate CableData billing equipment.
- Every local telephone company central office is capable of transferring ANI.
- AT&T had the necessary network features installed in the 4ESS™ toll switching equipment involved in the calls by the time of the trial.

The site does have one major complicating feature: the trial cable company's business management and billing processor is located in Cleveland and is accessed from Milwaukee through a 9.6-kilobit per second (kb/s) private line and an arrangement of data multiplexers. Viacom uses this configuration so that the processor may be shared with another Viacom cable company in Cleveland.

Trial Architecture. It was important that the trial begin quickly with minimal expenditure of resources. Thus, a primary requirement was that the trial require little or no AT&T hardware or software development. This is a marketing trial so that, although it must exactly match the final service at the consumer interface, it need not use the same internal network technology. Hence, the trial was set up to *emulate* AT&T's concept of a national ordering system (Figure 1) and, presumably, the eventual service, but using an arrangement of *existing* AT&T network capabilities. These include:

- 800 service call routing capabilities
- DIAL-IT® 900 service mass announcement capabilities
- Feature group D exchange access signaling
- Automatic number identification (ANI)
- Common channel signaling (CCS)
- Special access data channel (SADC).

The trial architecture is shown in Panel 1. In the trial, a consumer orders a pay-per-view event by dialing an 800 telephone number. Within the AT&T network the call is



Panel 1: Trial Architecture

1. The consumer tunes to the pay-per-view channel, then dials "1-800-VIEWER1."
2. The call is routed to the 4ESS in Waukesha.
3. The 4ESS obtains the caller's telephone number by automatic number identification (ANI).
4. The call is directed, using 800 service call routing to the 4ESS in Cleveland, which connects it to the AT&T mass announcement system (MAS) node.
5. The 4ESS in Cleveland requests and receives the caller's telephone number from the Waukesha 4ESS via common channel signaling (CCS).
6. The 4ESS passes it, together with a code for the called number, to the cable company business management processor via a special access data channel (SADC).
7. The business management processor verifies the caller in its subscriber database.
8. The business management processor passes the consumer's identity to the addressable system controller in Milwaukee via the multiplexer and private line arrangement between Cleveland and Milwaukee.
9. The controller causes the addressable converter in that consumer's home to descramble the pay-per-view channel.
10. The charges for the pay-per-view program are later included on the consumer's monthly cable bill.

routed to one of the barge-in mass announcement system (MAS) nodes used in DIAL-IT 900 service, which gives the caller an announcement acknowledging the order. This MAS node is located in Cleveland.

Along with the call, ANI information is received from the local exchange carrier, Wisconsin Bell, using equal-access feature group D signaling. Every Wisconsin Bell central office serving the trial area was equipped with this feature prior to the start of the trial as was the AT&T toll switch on which they home, a 4ESS switch located in the Milwaukee suburb of Waukesha, Wisconsin.

The ANI information is passed through the network via CCS to a 4ESS switch in Cleveland near where the trial cable company's business management processor is located. The Cleveland 4ESS switch transmits the ordering information to the cable company's business management processor using an SADC link. Physically, this link consists of a 4-wire analog private data line, duplicated for reliability, operated at 4800 bits per second (b/s). Standard synchronous data protocols, based on those of the *Integrated Services Digital Network* (ISDN), are employed.[1]

The business management processor, a Tandem NonStop™ system, contains special application software developed for the trial and integrated into the processing system by CableData. This software receives, verifies, and validates the order, and transmits commands back to the addressable system controller in Milwaukee to authorize descrambling in the consumer's addressable converter. The cable company later bills the consumer for the purchase of the pay-per-view event using its normal billing process.

Trial Order Processing. A description of the trial order-entry process is as follows:

1. The consumer determines what to watch. In the trial, there is one pay-per-view channel that carries VIEWER'S CHOICE programming. A recent hit movie is shown on this channel continuously all week. Each week the movie is different. There are six showings per day at 3-hour intervals. The movies are advertised in the cable viewer's guide and in bill inserts. In addition, there is a 24-hour-per-day "barker channel," a separate cable channel that continuously shows promotions for the current movie and for coming attractions together with ordering instructions. Finally, there are 30-second commercials inserted by the cable company in "locally available" spots on several of the basic cable channels such as ESPN® and Music Television® (MTV).
2. To order a movie, the consumer must first tune to the pay-per-view channel. (At this point, the channel is not yet authorized and only a scrambled signal may be seen.)
3. The consumer then dials the VIEWER'S CHOICE 800 telephone number: "1-800-VIEWER1." The telephone may use either touch-tone or dial-pulse signaling; however, the call must be made from the consumer's own home telephone. This restriction is not considered a problem because the call may be made as late as a few minutes or even a few seconds before the start of the movie so that there is no need to order in advance while away from home. Actual trial experience has shown that many people call even after the movie has begun.
4. The call is routed, as are all 800 calls from

the trial area, to the nearest AT&T 800 originating screening office, the 4ESS switch in Waukesha. At this point, the 4ESS switch obtains the caller's telephone number from the local exchange carrier by *automatic number identification* via feature group D signaling.

5. The call is directed, using an AT&T 800 service call routing technique, to the 4ESS switch in Cleveland, which connects it to the AT&T mass announcement system (MAS) node. The MAS provides the "thank you" announcement to the caller. The announcement is only 5 seconds long to maximize the call handling capacity of the MAS node. If the caller does not hang up immediately, the announcement facility automatically disconnects the call after two cycles of the announcement.
6. The 4ESS switch in Cleveland requests and receives the caller's telephone number from the Waukesha 4ESS switch via CCS and passes it, together with a code for the called number, to the cable company business management processor via a special access data channel (SADC).
7. The business management processor receives the information and consults its online subscriber database to identify the caller. The processor verifies that the caller is a subscriber, that their account is current and in good standing, that they are authorized for pay-per-view, that an addressable converter is installed in their home, and that this order will not exceed their credit limit. A record is kept of those orders that do not lead to positive verifications; the cable company pursues these as potential customers or to secure payment of an outstanding bill.
8. The business management processor then passes the consumer's identity to the addressable system controller in Milwaukee via the multiplexer and private line arrangement between Cleveland and Milwaukee. The controller causes the addressable converter in that consumer's home to descramble the pay-per-view channel giving clear, immediate confirmation that the order has been processed.
9. The charges for the pay-per-view program will appear later on the consumer's monthly cable bill. The bill is fully itemized and shows the date, time, title, and price of each pay-per-view event ordered.

Traffic Capacity of the Trial. The traffic capacity of the trial system was designed to handle any peak demand that could reasonably be expected. Because the system is composed of a sequence of processing steps, its ultimate capacity is determined by the capacity of it's slowest component. An analysis of the capacity of each component follows.

AT&T network capacity. The AT&T network components associated with the trial are engineered to handle up to approximately 300 calls per minute, which was confirmed by load testing prior to the start of the trial. The local telephone company central offices have far greater capacity and so are not a limitation.

Business management system capacity. CableData's application software performs the functions of order reception and converter authorization at high operating system priority, which maximizes the hardware capabilities of the processor. System benchmark tests conducted by AT&T and CableData determined that this system could run at 300 calls per minute, matching the capacity of the AT&T network.

Addressable system capacity. The Zenith addressable system installed in Milwaukee uses a now outdated system controller whose capacity is less than 20 calls per minute. This is the limiting system component. Zenith, in consultation with the trial partners, is working to replace this processor prior to the end of the trial. Nevertheless, the capacity of the addressable controller has thus far been adequate for the traffic loads observed in the trial through December 1986.

System overload. The system is designed to handle an overload should it occur. If calls arrive at such a high rate that the AT&T network components are overloaded, callers will hear a standard reorder tone ("fast busy"). The other system components are all designed to buffer information that can not be immediately processed so that, under overload conditions, orders are simply delayed, not lost (assuming the overload is not so massive that the buffers themselves overflow).

Trial Data Collection. To ensure that the trial objectives are achieved, AT&T uses a number of different but complementary measurement systems to gather detailed data on system performance and consumer usage.

The number of calls to the 800 number on a day-by-day basis is obtained from the AT&T 800 service Marketing Support System. Counts of calls that reach the MAS node are also available.

In addition, a major source of data is the automatic message accounting records (AMA) that are generated both at the originating 4ESS switch in Waukesha and at the terminating 4ESS switch in Cleveland. The terminating AMA records form the basis for the AT&T bill to SHOWTIME for the trial calls. The originating AMA records are used to provide detailed call arrival data. A package of analysis software, developed by AT&T Bell Laboratories, allows varied and complex marketing and network performance analyses on these data.

Finally, a commercially available protocol analyzer is used in Cleveland to continuously monitor the messages flowing over the SADC link. This is the formal end point of the AT&T network and the beginning of the cable company's processing responsibility. The protocol analyzer can continuously record key portions of the data and periodically relay it back to the Bell Laboratories trial team in Holmdel, New Jersey for detailed analysis. These data, when combined with the AMA call arrival data, permit a detailed call-by-call analysis of the AT&T network in terms of lost, mishandled, or delayed calls. It also allows any problems to be roughly sectionalized and any discrepancies between SHOWTIME's and AT&T's call counts to be resolved. The protocol analyzer was also useful initially when the system was being brought up and tested.

Results

As this paper is being completed, the trial has not ended and results are not yet final. Nevertheless, measured by the standard of lessons learned and assumptions clarified, the trial has already been very successful. Some of the early lessons are:

- *The trial system has been reliable.* There have been no known system malfunctions in the AT&T network portion of the system. There was only one major outage in the cable company's business management system when a heavier than normal calling load uncovered a

previously undetected bug in the system software. The bug was promptly fixed and the problem has not recurred.

- *The trial system has been easy for cable company personnel to operate.* This is an important result if the system is to receive wide acceptance in the cable industry. The system requires a few minutes per day of administrative activity at the business management system, which should be eliminated in future releases of the CableData application software. It has also been necessary for cable representatives to deal with occasional customers whose orders have been rejected because their bill has not been paid, their home telephone number has changed, or for other reasons.
- *Consumers report that ordering movies by dialing an 800 number is simple and easy.* Consumers appear to be so comfortable with the system that ordering is virtually an invisible process to them. The issues of price and quality of the movie are their principal concerns. This is exactly the result for which the trial partners had hoped.
- *Consumers are slow to recognize and use the new technology.* Despite intense promotion, it has taken over four months to reach the ordering level originally projected. The traffic volume continues to grow as more and more people who have never used the system before try it for the first time.
- *Ordering decision patterns have not been as impulsive as had been expected.* This means that traffic volume has not been as peaked. For example, it had been expected that all orders would come in the last half-hour before the movie and that a substantial portion would come in the last five minutes. Actual trial experience so far has shown that orders are spread out over roughly the last hour, with far fewer then expected in the last five minutes. Surprisingly, a significant number of people call even after the movie has begun. Traffic peakedness has increased gradually however, as consumers become more experienced with the system and less wary about calling at the last minute.
- *Consumers are very persistent.* If their screen does not descramble within what they consider a reasonable time, they will call the 800 number again and again. This means that the consequences of lost or delayed calls are that still more calls arrive. In the future, designing fast and reliable systems will benefit all concerned.

Conclusion

The partners in the trial, AT&T, SHOWTIME, and Viacom, together with CableData, believe they have an important concept for the fundamental health and growth of the pay-per-view industry. It has the potential to satisfy the requirements of pay-per-view ordering as outlined in an earlier section.

Because of these positive trial results, AT&T recently announced plans to offer a new 800 service feature, AT&T INformation FOwarding, that will support the nationwide service described above. The feature will be available on a limited basis early in 1988. Thus, the value of network trials in understanding new markets and their characteristics has, in this case, been clearly proven.

Reference

1. AT&T Communications, "Special Access Data Channel Interface," *Technical Reference Publication 41460*, October 1984.

Appendix A. One-Way Addressable Cable Systems

All one-way addressable systems function in generally the same way. Most cable television systems operate in a "one-way" or broadcast mode. That is, they are capable of transmitting in only one direction—outbound from the cable headend to subscribers' homes.

In a one-way addressable system, the programming on one or more channels is transmitted in scrambled form on the cable. The addressable system inserts a data channel somewhere on the cable that communicates with the cable converters in subscribers' homes.

Each individual converter has electrically stored within it a unique identification number or "address." The data on the data channel is in the form of messages, each of which is addressed to an individual converter described by its address. The messages can instruct each individual converter independently to turn descrambling on or off for particular channels or groups of channels. Because of the one-way nature of the cable, the system is open-loop, i.e., commands can be sent from the cable headend to individual converters but the individual converters can not answer back or in any way confirm that the commands were received and executed.

In the Zenith system used in the trial, the data channel is carried in the vertical blanking interval of the scrambled channels so that the converter must be tuned to one of these channels to receive the addressing messages. This is why consumers are instructed to tune to the pay-per-view channel prior to ordering.

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