COMPARATIVE STUDY OF HYBRID-IPPV IMPLEMENTATIONS

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INTRODUCTION

The cable business has reached a stagnant stage with dwindling revenues and needs a new marketing approach to generate additional revenue and increased subscriber penetration. The success of Impulse-Pay-Per-View would seem now to be limited to the small percentage of cable systems with two-way capabilities. Some other less radical technology for collecting user requests on an impulse basis will be necessary to bring the potential benefits of IPPV to the vast majority of cable operators.

The public telephone network can readily be used to collect user requests while the cable system is providing the video programming. Economically and technically this is the only basis for a solution at present. Hybrid Impulse-Pay-Per-View, as it is called, has been implemented or considered in several forms: this paper describes and compares them. It then proposes a new approach utilizing both the present telephone system technology and real-time computer capabilities. The proposed scheme also offloads the central office switch and allows a large number of calls to be processed at higher capacity than standard call switching. The high volume of requests that are passed to the cable headend must be translated and validated by the headend computer to allow for timely authorization of addressable decoders. This approach overcomes most of the problems associated with other forms of hybrid Impulse-Pay-Per-View implementations.

HYBRID-PPV

Hybrid-PPV is a system for distributing PPV programming in an addressable one-way cable system where the orders can not be received through the cable plant itself. In a Hybrid-PPV system, the broadband coaxial cable is used to deliver video programming while user requests are gathered through the conventional telephone switching system, replacing the upstream return cable path with the telephone network. Moreover, 'impulse' buying becomes possible if the central office switch and trunks can be offloaded by frontend call processing.

Methods discussed in this paper are: manual call-in, auto-dialing, credit downloading, touch-tone ordering and ANI (Automatic Number Identification) ordering.

MANUAL CALL-IN

This is the current 'solution' used by most cable operators. Customers call in and tell an operator what program they want to buy. This information is then entered into the billing computer which, in turn, instructs the system controller to authorize the decoder.

This solution makes heavy use of phone lines, tying down a physical circuit for a relatively long period of time, approximately three minutes per transaction. In addition, it has a very limited capacity, results in blockage of orders, discourages ordering of 'R' or 'X' rated materials and has high transaction costs. Because of the delays and limited capacity it cannot be considered an 'impulse' PPV system.

Part of the reason for the delay is that customers must identify themselves orally. This oral identification must be confirmed and translated into a decoder address for the order to be processed. This system is relatively sensitive to human error at both ends, and the cable operator has no control over how long a transaction may actually take.

AUTO-DIALING

An auto-dialing system alleviates some of the problems of manual call-in by establishing the connection automatically, transmitting the

information to the headend and then immediately terminating the connection, all in response to the customer pushing a button (or some other simple action). The customer interface is simpler, and identification of the customer is fast and error free. The duration of the call is shorter, averaging ten to fifteen seconds, and its processing is not labor intensive.

However, the auto-dialer is an additional (possibly expensive) piece of hardware that must be bought, installed, maintained and tracked. It is also subject to certain limitations inherent in any call-in system, most significant of which is a relatively low limit on the number of late calls. It is, therefore, not really an 'impulse' but rather an advance-buy system.

CREDIT DOWNLOADING

One solution to the mass call-in problem is to allow the decoder to authorize itself, and then call in or be polled at a low background rate. Some sort of ordering limit is downloaded from the controller. This solution does allow a very high rate of last minute purchases and has low variable costs per transaction.

However, this is still an add-on unit (or a replacement, more expensive than a simple decoder), which must be bought, installed, maintained and tracked. It may even require an additional telephone jack. It is vulnerable to abuse and malfunction. If the decoder can self-authorize then there are likely to be numerous ways that cheaters can prevent it from reporting the purchase. It solves the 'impulse' problem at the expense of reliability, security and economy.

TOUCH-TONE ORDERING

A touch tone ordering system allows the customer to call up and 'talk' to an automatic order-taking device by pressing a sequence of digits on the touch tone phone after the connection has been established. It requires no additional hardware in the home, and no manual processing of the orders. However, touch tone is not universal (approximately fifty percent of customer premises equipment cannot handle touch tone dialing) and it still requires a large volume of incoming calls each with a moderately long connection time (an average of sixty to ninety seconds). The subscriber or user has to enter a relatively long stream of digits, which increases the probability of error.

INHERENT LIMITATIONS ON TELEPHONE HYBRID PPV SYSTEMS

No automatic system can provide high volume phone hybrid PPV service if it requires a completed phone call - even if it could somehow process the request instantly.

The first inherent problem is that the ordering customer must be identified. Customer entry is error prone and slow. Auto-dialing units are additional hardware and cost.

Most importantly a physical phone connection (circuit switching) must be made. Phone systems are not designed to connect the cable operator to all of the subscribers who might want to order in the last 30 minutes, let alone the last five.

The telephone switching system is designed for long point-to-point sessions averaging three minutes. Hybrid-PPV needs to pass one simple request and perhaps receive an acknowledgment. The phone system is designed around random independent usage, with 6-12% of all potential connections active at maximum. See the illustration "Physically-Connected Hybrid Pay-Per-View", which shows that a normal call between two local switches ties up the scarcest resource in a telephone system, the trunks. PPV traffic is bursty in nature. A Hybrid-PPV system wants to take as many orders as possible as late as possible. The timing of orders is decidedly non-random.

A telephone circuit is a powerful resource, designed to carry the information in a full duplex audio conversation. The connection time represents a significant portion of the total operating cost of a circuit switching telephone system. PPV ordering horribly underutilizes it. It is also the most scarce and critical resource in a phone system. The cable operator cannot afford to buy, nor can the telephone switching system afford to provide the number of last minute physical connections that would be needed to support Hybrid-PPV. The surge of requests for telephone circuits would overload the switching system.

THE ANI SOLUTION

The acronym ANI (Automatic Number Identification)will be used to designate a class of hardware/software systems developed by various telephone companies to accommodate alternate long distance carriers and large PBX's. This class includes the "Bulk Calling Line ID" system. The following discussion will concentrate on common features of these systems.

The four main requirements for a complete ANI solution for Hybrid IPPV are as follows:

determine caller/selection without making a connection for each order.

reliably relay this data in real time to the cable operator for automatic processing.

perform required processing including addressing and authorizing the decoder.

post transactions into billing system.

GETTING THE ORDERS

ANI alleviates the overload problem by intercepting the ordering 'call' before it becomes a physical connection. It extracts the information required (caller telephone # and caller-entered digits pertaining to ordering information), and passes it out in serial data output form. Because physical connections are not set up the switch is not overloaded. See the illustration "The ANI Solution for Impulse Pay-Per-View" for a graphic depiction of the (pardon the expression) "bypass" of the local switches and trunks made possible by the ANI system.

The caller is also reliably identified because the calling phone # is supplied automatically by the switching system itself, so that no customer entry is required.

To place an order the caller takes the phone off the hook, waits for a dial tone, and then enters information (some of which will be fixed format routing information, some used for specifying the order). Consequently, the call is acknowledged with a tone or voice response.

GETTING THE DATA TO THE CABLE OPERATOR

The telephone switching system will provide serial output at 1200 Baud from each Central Office. There are several problems which must be overcome with this data format:

It is at the wrong place. It must be relayed to the cable operator's premises for processing. There is simply no feasible way for the cable operator to maintain a decision-making processor and its required data at the central telephone office.

It is probably at several wrong places. Unless the cable franchise is very small it will probably be served by multiple central offices.

It comes at its own pace, because there is no pacing protocol. The receiving device is presumed to be available and working at all times.

It assumes the data is correct. There is no error detection capability, let alone the ability to request retransmission of a garbled message.

Most of the problems can be worked around with reliable high speed modems which accept the data and forward it to the cable operator office. These modems must have their own buffering, error detection and retransmission capabilities.

At first glance it might seem strange to intercept phone calls and then forward the data over a phone line. However, the requests have been multiplexed at the central office so that only a single line is required.

At the receiving end the data from the various central offices must be multiplexed and buffered for input into the main processing computer. Even at 1200 baud, a computer dealing with multiple input streams along with complex processing and output requirements, cannot reliably accept unpaced input. It can try, it might even look like it's working, but in the field some messages may be lost, and every lost message represents what would have been a satisfied PPV customer and a sale.

PROCESSING THE DATA

Data must be dealt with in real-time. For example, if there exist four central offices sending three transactions per second, then twelve transactions per second should be multiplexed on a single connection to the cable headend. For larger systems there may be more central offices. Later ANI software/hardware from the telephone companies will probably have even higher capacities.

Customer pictures must unscramble within seconds of making the phone call. Otherwise there is no feedback on the success of an order. If they supplied an incorrect event #, or if their phone # is not correctly entered into the database, there will be no error indication until they fail to see the program they wanted. By then it is too late.

What must be done at these rates of 20 per second (or more) is: first identify the decoder based on the originating phone # and possibly some of the input data (to allow for more than one box per house), then identify the event being ordered. This information must then be passed to a decoder controller system.

Depending on the rules for addressing the decoder, and how much data is required, processing each transaction will require going through one or two indexes. This will require a real-time computer, not a general purpose billing computer. Billing computers are designed to handle large amounts of data and history about customers and decoders , not to shovel data in and out this quickly.

This real-time processor can control the addressable decoders in one of three ways:

it can include controller software within itself and thereby talk to them itself.

it can communicate with a controller using a special optimized protocol designed for the application.

it can pretend to be a billing computer and instruct existing controllers. This is not likely to be feasible in many situations. Since billing computers are not designed to process high data volumes in real time few controllers will expect or be prepared to take 16 or more unsorted 'turn on' commands per second from their billing computer interface.

POSTINGS

Transaction records must be written to disc as quickly as possible, then uploaded to the billing computer. Some billing computers have developed an uploading capability to support two-way IPPV ordering. ANI IPPV postings should be similarly uploadable and processable.

OTHER DEMANDS ON THE MAIN PROCESSOR

The main ANI processor has to be more than just a dumb pass-through machine with posting. There are a number of other activities which it either must or should manage as well, making it a complete IPPV management system.

It either acts as or connects to the addressable decoder control system. Since only a deranged controller would be prepared to deal with two management computers, it must totally manage the addressable decoder functions for the billing computer. This can be done by providing a complete higher level definition of the whole problem, and using the actual addressable system controller to implement parts of it. More realistically, some degree of 'pass-through' command must also be provided.

Orders will have to be taken in advance, often farther in advance than the system controller can handle. Since the ordering numbers will have to be published, many customers will advance order in case their phone is tied up later. The channel or tag that must be authorized for the event may not be available yet, due to conflicting earlier usage, thus requiring the "buffering" of authorizations.

Unless the cable operator wants to have extra staff present for the start and finish of each PPV program there must be an automatic schedule which controls when ANI orders will be taken and required decoder controller scheduling tasks as well. Taking part of the task of scheduling, particularly that of program tag allocation, is not feasible. Once one bite is taken, the whole task must be assumed.

BRIDGE TO TWO-WAY IMPULSE PPV

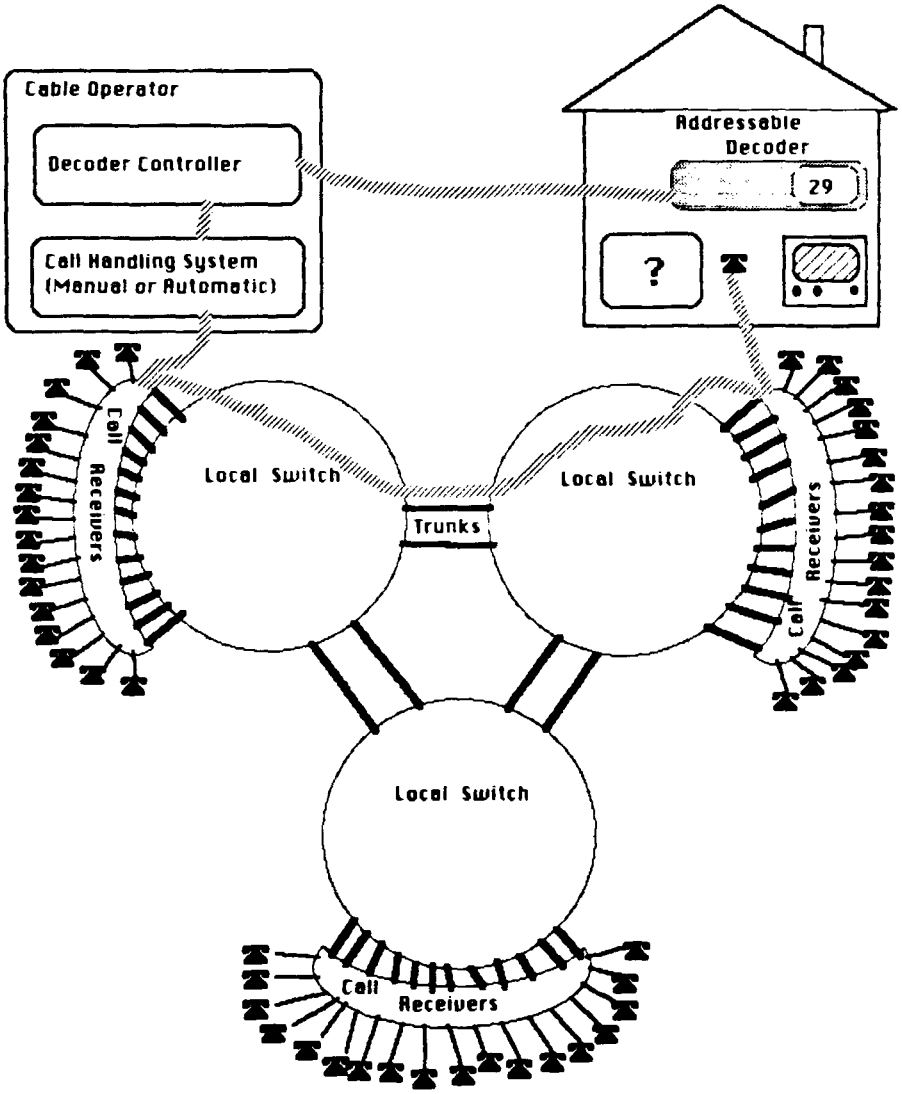
The main advantage of ANI as a hybrid PPV system over a real two-way plant Impulse PPV solution is low startup cost and risk. However once a successful IPPV market has been established it would make sense to phase over to an interactive two-way IPPV solution with its lower transaction costs and higher speeds. A good IPPV management system should facilitate this transition by providing a single source of control for all PPV scheduling and a single source for PPV postings.

CONCLUSION

If Pay-Per-View will provide the revenues cable operators need to become profitable; if the ability to buy on an impulse is a significant key to that profitability; if building a new two-way plant or upgrading an existing one is an unreasonably risky expense for a prudent operator, then the ideal solution is a hybrid system involving the public telephone companies.

Given the serious problems with traditional approaches to hybrid PPV, only the ANI-based system with a real-time IPPV processor on the cable operator's premises can provide the necessary functionality.

PHYSICALLY-CONNECTED HYBRID PAY-PER-VIEW



THE AmI SOLUTION FOR IMPULSE PAY-PER-VIEW