RESIDENTIAL TWO-WAY CABLE APPLICATIONS

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ABSTRACT

Many residential two-way cable plants in existence today are not taking advantage of the revenue opportunities that are available to them. The number of active two-way CATV miles in the past were increasing but are now actually declining. There are many applications that utilize a two-way cable plant and this paper explores three major ones. They are: status monitoring, impulse pay-per-view and data transmission service. The premise is that individually these applications are not currently significant or even cost-effective, but when implemented in combination with each other, could make an attractive and profitable operation.

INTRODUCTION

The CATV industry today has more than 310K two-way capable miles of plant of which only 12% is currently active. Table A shows the growth of CATV plant miles, two-way capable and two-way active miles over the last four years. Although the industry has attempted to implement two-way interactive cable plants, the success rate has been very sparse. While the initial investment for two-way active plant is high (relative to a one-way plant), the long range revenue potential is very attractive. It is this revenue opportunity that can be realized through status monitoring, impulse-pay-per-view (IPPV)and data transmission service.

These specific opportunities will be explored in terms of application, costs involved to implement and advantages and disadvantages of each.

PLANT DESIGN

The first place to start is with an explanation of what a two-way active system is. This refers to a plant used to transmit information both up and downstream. The majority of coaxial cable installed today is capable of carrying bi-directional signals. This includes both new-build systems and rebuilds.

Equipment should no longer be a technical stumbling block.
The amplifiers required to bring back the return signal are easy to install, plug-in modules. Technology advances have eliminated many of the earlier technical problems with a two-way plant to the point where the equipment is now very good.

Table A

TWO-WAY MILES

YEAR	TOTAL PLANT (K MILES)	TWO-WAY CAPABLE (K MILES)	% OF TOTAL PLANT (K MILES)	TWO-WAY ACTIVE (K MILES)	%OF TOTAL PLANT (K MILES)	% OF 2-WAY CAPABLE (K MILES)
1982	383	168	44.	29	8.	17.
1983	440	212	48.	43	10.	20.
1984	518	253	49.	72	14.	28.
1985	564	310	55.	68	12.	22.

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All current return paths are limited to the 5-30 MHz bandwidth. This small range of bandwidth does constrain a cable operators ability to provide extensive two-way active services.

One potential alternative is to take advantage of the increased bandwidth capability of amplifiers that now operate in the 550-600 MHz range. These upper end frequencies are less affected by noise and interfering signals. The current constraint on this idea is the fact that manufacutrers do not currently have available the high end frequency return amplifier modules. Additionally the return signal transmission in impulse-pay-per-view systems are not designed for other than 5-30 MHz.

Deregulation of the must carry rule should have positive impact on some operators, who could then free up some high end band space of their systems plant for a return path. Here again however, return path hardware must be designed to handle those frequencies.

STATUS MONITORING

Status monitoring and control systems have gone from a luxurious extra to a basic requirement for a cable plant. The present market for status monitoring and control equipment demands technology that can provide information on the overall operating condition of the CATV plant. This system will detect and report faults in a system before disruption of service occurs and control certain amplifier and standby power supply functions for multiple hub systems, both locally and remotely from the master headend.

The primary objectives of status monitoring and control systems are:

- increased plant reliability through reduced downtime
- reduced maintenance costs
- knowledge of equipment operation over entire plant
- better utilization of manpower for maintenance and system operations
- prevention of catastrophic failures through trend analysis and alarm history

These objectives are all very basic and meaningful to operators on a day to day basis.

Status monitoring and control systems have application for the functions as shown in Table B.

These functions are critical to control and can improve the performance and reliability of a cable system.

When considering implementation of a status monitoring and control system, costs, advantages and disadvantages must be considered. Unfortunately, an easy economic analysis of this is not practical. This is due in part to the variable cost, based on system size, condition of the plant, and plant operating costs. An operator should, however, attempt to identify on an individual basis, what the bottom line benefit should be.

The equipment cost would be a headend computer such as an IBM PC plus plug-in modules for each amplifier and standby power supply. This cost will vary directly with the cable plant size.

Table B

STATUS MONITORING FUNCTIONS

EQUIPMENT	FUNCTIONS MONITORED AND CONTROLLED
Amplifier	. Forward RF level measurements (carrier frequency) . Reverse RF level measurements (carrier frequency) . Control of return feeder switch . Attenuating return feeder path . Controlling other amplifier switches . Monitor intrusion via amplifier housing tamper switch
Standby Power Supply (designed & mounted internally to the type of power supply)	. Battery voltages, system load levels and measure temperature . Cabinet tampering . Charger/inverter malfunctions . AC/standby switchover status

Some of the advantages, however, from this system can on an individual system basis be turned into dollar savings. This includes the savings from reduced truck rolls, the time saved in troubleshooting (go directly to identified trouble area) and increased overall operating efficiency. Additionally, newer status monitoring and control systems have reduced the number of adjustments required to set up and maintain a system. The operator will need to assess his own number of field failures, average trouble shooting time and number of errant truck rolls and assign a dollar amount to each.

Given this economic analysis is favorable, the operator should also consider some disadvantages, beginning with the capital required to install a status monitoring and control systems. Another major concern should be that this monitoring and control system is another piece of equipment to maintain (including everywhere in his system) and if he doesn't believe the reliability is very good this additional system may be more of a burden than a benefit. This could translate into more problems due to faulty alarms.

As one can see, there is not a clear cut numerical analysis to determine the need for and value of a status monitoring and control system. A status montoring and control system offers the operator an instant overview of a system's critical components, provides a smooth running system and, last but not least, peace of mind.

IMPULSE PAY-PER-VIEW (IPPV)

Having an active two-way cable plant offers an operator the opportunity to offer his subscribers pay-per-view program services. There are two distinct technologies for these services: real-time advance order, and store and forward. In either case, the cable operator's intervention during the ordering cycle is eliminated.

All of the real-time systems require the establishment of a closed-loop communication link between the subscriber and the headend computer system before a subscriber can view a pay-per-view program. The transaction time is not instantaneous, and closed-loop communications for order processing is required for each participating subscriber. It is not unreasonable to expect that with a substantial subscriber base, subscribers will have to order programs in advance of the showing to guarantee sufficient time for processing and communication of program authorization.

Real-time systems also demand that the entire ordering system be operational prior to the program, or potential orders will be lost. A last minute equipment or communication link failure will result in lost revenue opportunity and frustrated subscribers.

Seeking to overcome the limitations of real-time ordering systems, a pay-per-view technology known as store and forward was designed. This ordering system can provide an effective solution to anticipated operational problems associated with traffic bottlenecks caused by peak order loads. The store and forward technology poses no limits to the number subscribers that can order an event, and provides instantaneous program authorization for immediate subscriber viewing.

In a store and forward system, converters are pre-loaded with purchase credits against which subscribers order PPV programming. The subscriber orders a PPV program by entering a secret personal identification code, either directly on the converter or using the handheld remote unit. If the subscriber has sufficient credit, he receives instant authorization to view the program. The converter is not required to communicate at that immediate time with the headend system in order for programs to be cleared for viewing. At the time a program is purchased, a program identifier and time stamp is stored in the converter's non-volatile memory. Later, on a non-real-time basis, the addressable controller collects this program purchase information for subsequent billing. Every subscriber in the cable system can order an "event" or program up to the last minute before a showing, or even during the first few minutes of a program, depending on the cut-off ordering time determined by the cable operator. In this way, consumers are able to buy on a true "impulse" basis. The store and forward technique is the only IPPV scheme available today that does not require real-time communication and data processing; it totally avoids real-time bottlenecks in the control system.

The capital and variable costs associated with a two-way cable IPPV system are basically, (1) the additional cost to make the cable plant two-way active, and (2) the two-way terminals (converters). There is no real variable cost on a per event basis for a two-way IPPV system versus additional costs for some one-way IPPV systems.

The key advantages and disadvantages are shown in Table C.

DATA TRANSMISSION

A subsplit two-way residential plant can serve the needs of banks and other businesses with multiple offices in the franchise area. Transmission of data is another opportunity for the cable operator to generate revenue.

From a system standpoint, what is required to generate data revenues is a network with two-way capability and at least one free channel in the forward (downstream) direction corresponding to a reverse channel offset by 156.25 MHz or 192.25 MHz.

Assuming the two-way active plant exists, the additional costs involved to transmit data include: installation of additional headend equipment, supplying data modems and providing drops to business customers.

For the system headend, each 6 MHz channel requires one headend frequency transverter to translate incoming (upstream) low frequencies to higher outgoing (downstream) frequencies for communication between users.

The number of data modems needed varies with the number of channels used, number of multi-point circuits and the percentage of available data circuits used.

The last capital expense is providing cable drops to the business customers. The cost of providing a drop to a business user must be estimated on an individual basis.

In addition to capital expenses, there will be additional operating expenses which include: personnel and administrative, and maintenance and spare parts. Some of these expenses will vary with the number of data channels used.

There are many factors that have an impact on the amount of revenues that can be expected from business data transmission are; data speed, local phone alternatives, quantity of lines needed and length of contract.

Transmitting business data over residential cable systems is financially attractive for existing systems that can allocate two or more TV channel pairs for data. Using two channels, payback could occur in the range of 2.5 years. Using four channels reduces payback to approximately 18 months. This is achieved assuming a 70% use of available data circuits. Any increased use of available circuits will provide more rapid payback. This analysis is intentionally left brief due to the many variations and tax implications for each operator. Depreciation, investment tax credits, tax savings (or debits) are not reflected in these projections.

In the legislative arena, the controversy surrounding regulation of programming services has become more definitive with the Cable Act of 1984. Regarding data, however, the Act did little to clarify the authority of State Public Utility Commissions to prohibit or regulate services. The FCC has shown, however, that it will overrride state PUC's that try to impede this fledgling business from offering its services. In a recent ruling, the FCC stayed an order by the Nebraska State Public Service Commission preventing Cox Communications from offering data services in Omaha via its Comline subsidiary. The FCC argued

TABLE C

Technology	Advantage	Disadvantage
Interactive (Real Time)	. High User Friendliness . No variable cost per event	. High 2-way plant & terminal investment . High 2-way plant maintenance . Limited Peak Order Capability
Store and Forward	. High user Friendliness . Unlimited peak order capability . No variable cost per event	. High 2-way plant & terminal investment

that Comline offers interstate services through its MCI Communications link and that the Nebraska Commission overstepped its bounds.

This ruling, although encouraging, does not definitely state how it will act in future cases. In most cases, it is recommended that cable operators get some sort of reading from the local commission on their position regarding data services over the cable network. While some PUC's are heavily influenced by local telephone companies and seek to discourage such services by cable, others are more favorably disposed and view it as healthy competition.

POTENTIAL APPLICATIONS

The applications for two-way cable continue to expand with interactive services such as home banking and shopping, games, etc. There are currently cable operators taking advantage of their plant capabilities with home security systems, meter reading and energy management systems. While these are in their infancy and high on the learning curve, they should not be abandoned. These applications, while perhaps somewhat in the future, are rapidly approaching a complete home information system.

CONCLUSION

The consolidated review table below shows the current and potential applications for a residential two-way cable plant.

APPLICATION

Status Monitoring
IPPV
Data Transmission
Engergy Management
Home Security
Meter Reading
Home Banking
Home Shopping

All of these applications, when implemented, can be revenue generating for the cable operator in one sense or another. The fact that operating costs can be reduced with status monitoring and subscriber revenue increased with IPPV, make two-way systems viable.

The real benefit to an operator is when he can expand his two-way cable system to include many of these identified applications. The cable operator is currently serving the residential community. The other side of this is the untapped commercial community needing data services. Considering this opportunity, as well as the expanding potential to provide services to its current subscriber base, should make the value of a two-way cable plant very clear.

Progress is made by taking calculated risks and exploring the unknown. A well designed and maintained two-way active cable plant can be a profitable operation.

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