# ANI - Strategically Attractive But Can It Handle Impulse Pay-Per-View

by

WILLIAM A. FREZZA

GENERAL INSTRUMENT CORPORATION

## ABSTRACT

Many issues must be considered by cable operators making a decision between an Automatic Number Identification (ANI) based approach to pay-per-view and a store and forward based approach. These include initial capital outlay, ongoing transaction costs, ease of use and its impact on buy rates, security, compatibility, availability, third party dependency, headend and billing system load limitations, and telco peak capacity. This paper briefly analyzes one and only one of these issues - can the local telephone office, utilizing ANI, handle the peak load generated by a succesful impulse pay-per-view business ?

## INTRODUCTION

Automatic Number Identification (ANI) has been proposed to solve a chronic problem of early telephone based pay-per-view services - telephone system congestion. Congestion caused by last minute order calls has been bad for both the cable operator and the local telephone company. Cable operators have lost potential business and aggravated customers, and the local telco has had basic phone service degraded or even disrupted.

ANI attacks this problem in two ways. First and foremost, it does not pass ordering traffic through the local switch. Rather, the primary resource in the local class 5 telephone office used to handle these calls are Customer Digit Receivers (CDRs). These units generate dial tone and interpret touch-tone or dial-pulse dialing commands. When a call is identified by the CDR as a pay-per-view order, usually by an assigned prefix such as *85 or a unique exchange code, special software installed in the office interprets the order command directly from the subsequent dialing sequence. The command is then relayed to the cable operator via a dedicated data link. This leaves the actual switching resources free to handle normal telephone calls.

An additional benefit of ANI over traditional methods comes from the relatively short holding times. In its simplest embodiment, where the system does not wait for real-time credit verification and a short order confirmation tone is transmitted rather than a recorded announcement, holding times can be kept as short as ten seconds.

Thus, the critical demand made on the local telephone office has been estimated at 10 call-seconds of CDR time per PPV order. (A call-second is the standard measure of holding time and represents, on aggregate, one call lasting one second. Thus, 100 call-seconds could be generated by one call lasting 100 seconds or 10 calls each lasting 10 seconds.)

## HOW MUCH IS TOO MUCH ?

Is 10 call-seconds per order a lot or a little ? This depends on four factors. These are :

1) How many orders will popular events solicit.
2) What fraction of these orders will come in the last minute or minutes prior to an event.
3) What background load of telephone traffic will the local telephone office be handling when the PPV orders come in.
4) How does the total load placed on the available CDRs by PPV orders, plus the normal telephone traffic load, compare to the design limits of the telephone office.

This paper will closely examine these four factors, quantitatively describing their interrelationships. This analysis makes two important assumptions. First, it assumes that the telcos, or at least the Public Utility Commisions, will find it unacceptable to have normal telephone service disrupted by pay-per-view ordering on any kind of a regular basis. Second, it assumes that customary safety margins will be adhered to in system design to avoid long term degradation of normal telephone service - principally exhibited in this case by abnormally delayed dial tone. The conclusions arrived at here will, of course, be mitigated to the extent that these conditions are relaxed.

## HOW MANY ORDERS ?

This brings us to our first attempt at predicting the future. How succesful will pay-per-view be ? Previous experience might serve as a guide with event penetrations running as high as 10%, however, the PPV industry can not be treated as a fully mature business. New services are being launched at a steady pace soon to be augmented by sustained national marketing and promotion. Some program providers even predict that in the not too distant future pay-per-view services may obtain rights to new movies before the video cassette rental stores. Multiple PPV services are also likely to become available on many systems, just as multi-pay services are available today. In these cases, total event penetrations at a given time slot must be considered when projecting loads.

Overall, prudence dictates that the analysis be performed at a fairly wide range of penetration levels. In the succeeding analysis, therefore, the effect of maximum event penetration (measured as the percent of cable subscribers that take a pay-per-view event or events during the most popular time slot) will be examined over a range from 10% up to 30%.

## HOW IMPORTANT IS LAST MINUTE ORDERING ?

Addressing the second issue, that is, estimating the fraction of last minute orders, is the most subjective part of this exercise. Rather than trying to predict gross behavior patterns (will consumers buy the product), we are trying to predict detailed behavior patterns (how will consumers want to buy the product and what will they put up with if they have no alternative.)

Ideally, buying a pay-per-view program should be as easy and as natural as changing the TV channel. Anything else is a compromise, perhaps a necessary compromise given the limitations of technology, but nonetheless a compromise. People are not in the habit of placing an advanced reservation to watch a TV show the way they would to go to a restaurant. In general, the TV comes on after dinner, stays on until bedtime, and the dial spins during commercial breaks, landing on the most attractive alternative.

The ideal demand function for pay-per-view ordering, therefore, will probably look a lot like the sharper curve shown in figure 1. The bulk of the orders will come during commercial breaks between network time slots. In fact unless disincentives are placed on the consumer, all of the ordering will gravitate toward the last five minutes before the event.

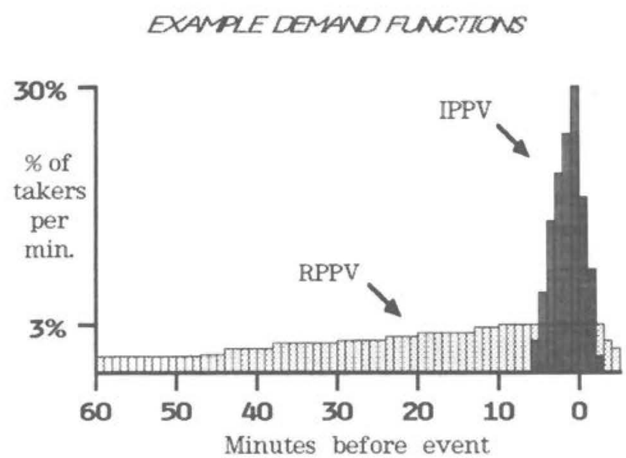


*Figure 1*

A system that can accommodate this sharp demand is by definition an impulse pay-per-view (IPPV) system. A system that cannot accommodate this type of demand and must, in one way or another, get the consumer to reserve the program in advance is a reservation pay-per-view (RPPV) system. The flatter curve in Figure 1 shows an RPPV demand function.

There is no doubt that ANI can handle RPPV, even at optimistic penetration levels. In fact, ANI may be overkill. In many cases, a well managed Automatic Response Unit (ARU) approach utilizing standard phone lines may be sufficient for RPPV. The question posed by this paper, however, is can ANI handle impulse pay-per-view. In the succeeding analysis, therefore, the effect of peak order rate (expressed as the maximum percent of total event takers that order in any given minute prior to the beginning of the show) will be examined over a range from 10% to 30%.

## WHAT ABOUT NORMAL PHONE TRAFFIC

An important consideration in analyzing an ANI system's capacity is estimating the load that normal telephone calls place on the central office CDRs during periods when pay-per-view programs are likely to be ordered. This traffic is well characterized. Residential telephone traffic has its peak between 9:00 AM and 10:00 AM, and then stays fairly constant until the evening hours, when it peaks between 7:00 PM and 8:00 PM (1). The morning peak generates on the average one call per telephone line during the busy hour, while the evening peak averages about 70% of this. It is this evening peak that coincides almost precisely with the beginning of prime television viewing time.

A typical telephone call will tie up a central office CDR for about 15 seconds, somehat longer than that estimated for an ANI PPV call. Peak load, then, will be about 15 call-seconds per line during the morning busy hour and 10.5 call-seconds per line during the evening busy hour.

## WHAT IS THE TOTAL LOAD

We can now add up the total load on the CDRs and compare it to the nominal design limit for a typical class 5 office in a residential neighborhood. The calculation will be performed for a median size 1A ESS of 24,000 lines (i.e., 24,000 telephone subscribers), although the results should roughly scale proportional to the number of lines for larger or smaller offices. Large cable systems, of course, could require the support of many telephone offices.

First, what is the nominal peak CDR load to which the example office is designed ?

Peak CDR Load = 15 call-sec./line/hr. x 24,000 lines
= 3600 CCS/hour
= 100 Erlangs

(For convenience, traffic intensity will be expressed in Erlangs, which is a dimensionless unit equal to one call-hour per hour or one call-second per second, etc.)

The next question is, how many CDRs are required to handle 100 Erlangs of peak load at a standard service level of p = .01. (A p = .01 service level ensures less than a 1 in 100 chance of not finding a CDR available when one is required.) Using the usual assumption of random arrivals, a standard Poisson Traffic Table (2) indicates that 125 CDRs will be needed. Additional CDRs are often installed beyond the nominal peak requirement as an added safety margin. As stated previously, however, we will assume that safety margins are not going to be relaxed simply because PPV has been added. (Thus would result in an implicit cross subsidization of cable subscribers by telephone rate payers, a practice frowned upon by various regulatory agencies.) Thus, any incremental ANI traffic that drives the total peak load on the CDRs above 100 Erlangs in our example case must eventually result in increased investment in CDRs, paid for by ANI customers.

Fortunately, the evening peak reaches only 70% of the morning busy hour, or roughly 70 Erlangs of CDR traffic. This leaves 30 Erlangs of "idle" capacity to handle pay-per-view. Is this enough ?

The tables on the next page show the incremental load generated by IPPV traffic for three penetrations of cable subscribers - 35%, 50%, and 65% of homes passed. Homes passed is related to central office size, in our example, by assuming that 85% of the telephone lines are primary residential lines, the rest being business lines or second telephones. In each case, the generated load is calculated for maximum event penetrations ranging from 10% to 30% of cable subscribers and peak order rates ranging between 10% and 30% of total event takers per minute. Average CDR holding times are kept constant at 10 seconds. (Longer average holding times will, of course, increase the IPPV load proportionately.)

Each entry in the tables is expressed in Erlangs and is calculated by the following simple formula.

CDR load (Erlangs) = size of central office (# of lines)
x primary residential line factor (%)
x cable penetration (% of hp)
x max. event penetration (% of subs)
x peak order rate (% of takers/min.)
x CDR holding time (sec.)
x 60 (seconds/min.)

## ANI CDR LOAD TABLES

FIXED PARAMETERS :

| | |
|---|---|
| SIZE OF CENTRAL OFFICE | - 24,000 LINES |
| % PRIMARY RESIDENTIAL | - 85 PERCENT |
| CDR HOLDING TIME | - 10 SECONDS |
| NOMINAL "IDLE" CAPACITY | - 30 ERLANGS |

ALL RESULTS EXPRESSED IN ERLANGS

**CASE 1**

| | |
|---|---|
| CABLE PENETRATION | - 35 PERCENT |
| NO. OF CABLE SUBS IN C.O. | - 7,140 SUBS |

| Maximum Event Penetration (% of subs) | Peak Order Rate (% of Takers) 10 | 15 | 20 | 25 | 30 |
|---|---|---|---|---|---|
| 10 | 12 | 18 | 24 | 30 | 36 |
| 15 | 18 | 27 | 36 | 45 | 54 |
| 20 | 24 | 36 | 48 | 60 | 71 |
| 25 | 30 | 45 | 60 | 74 | 89 |
| 30 | 36 | 54 | 71 | 89 | 107 |

**CASE 2**

| | |
|---|---|
| CABLE PENETRATION | - 50 PERCENT |
| NO. OF CABLE SUBS IN C.O. | - 10,200 SUBS |

| Maximum Event Penetration (% of subs) | Peak Order Rate (% of Takers) 10 | 15 | 20 | 25 | 30 |
|---|---|---|---|---|---|
| 10 | 17 | 26 | 34 | 42 | 51 |
| 15 | 26 | 38 | 51 | 64 | 76 |
| 20 | 34 | 51 | 68 | 85 | 102 |
| 25 | 42 | 64 | 85 | 106 | 128 |
| 30 | 51 | 76 | 102 | 128 | 153 |

**CASE 3**

| | |
|---|---|
| CABLE PENETRATION | - 65 PERCENT |
| NO. OF CABLE SUBS IN C.O. | - 13,260 SUBS |

| Maximum Event Penetration (% of subs) | Peak Order Rate (% of Takers) 10 | 15 | 20 | 25 | 30 |
|---|---|---|---|---|---|
| 10 | 22 | 33 | 44 | 55 | 66 |
| 15 | 33 | 50 | 66 | 83 | 99 |
| 20 | 44 | 66 | 88 | 110 | 133 |
| 25 | 55 | 83 | 110 | 138 | 166 |
| 30 | 66 | 99 | 133 | 166 | 199 |

[ ] - Below "Idle" capacity  [shaded] - Exceeds "Idle" capacity

As can be seen, a significant range of loadings exceed the "idle" capacity of the example office. In Case 2, where cable penetration equals 50% of homes passed, if an event or simultaneous events achieve a 20% penetration and 20% of these event takers call in the last minute, 68 Erlangs of CDR load are generated. ***This load is more than twice the "idle" capacity of that office.*** Keep in mind that this example only represents 408 people out of 10,200 subs calling in the last minute.

The situation gets progressively worse as penetration and impulse ordering goes up. Attempts to directly shed this load by immediately disconnecting PPV callers when they dial their first prefix digit (e.g., *) will not only result in lost orders and aggravated customers, but could lead to potentially unstable situations as callers repeatedly attempt to get through.

## CONCLUSION

One is drawn to conclude from this analysis that ANI was designed for reservation pay-per-view, not impulse pay-per-view. To expect idle central office resources to accomodate significant impulse ordering is unrealistic. In our example, a doubling in the number of CDRs could be required. Unfortunately, small scale field trials may not reveal problems that could become serious during a full scale rollout. Convincing customers to order in advance will also become more and more difficult as the volume of pay-per-view offerings goes up, with each show recieving a proprotionately smaller share of advanced promotion.

Cable operators and equipment suppliers should closely examine their traffic assumptions. While an additional investment in central office equipment can certainly alleviate overload problems, this investment must ultimately be reflected in transaction costs. It is unclear whether the current estimates of $.25 to $.50 per call reflect these costs. A careful analysis of ANI tariff filings should help resolve this issue. Meanwhile, cable operators should not foreclose alternatives that might better meet their long term needs.

## REFERENCES


1. D. Talley, Basic Telephone Switching Systems, (Hayden Book Company, Inc., 1969)
2. R. Freeman, Reference Manual for Telecommunications Engineering, (John Wiley & Sons, 1985)