A TECHNO-ECONOMIC ANALYSIS OF SELECTED ATM CHARGING SCHEMES FOR AGGREGATE LAN INTERCONNECT

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1. Introduction

After a slow start, European Telecom companies, are beginning to rollout ATM at a brisk rate during 1997. According to *Data Communications* magazine (Feb. 1997) up to 15 operators are now offering ATM at speeds up to 155Mbit/s and more are expected to following in the near future. Corporate network managers are beginning to realise the potential of ATM in terms of flexibility and quality of service offered. One of the consequences of this new flexibility is that corporate network managers will have to consider the ATM service categories and the type of service that can be delivered by transferring data across them. In addition a network manager will have to consider the cost of ATM and its constituent service categories. Thus, in addition to considering the cost of using ATM relative to substitute technologies, network manager will also have to consider the costs of sending data over the different service categories *within* ATM, subject to a given quality of service. This is one of the issues investigated here along with further economic aspects of ATM, focusing on on a single service, LAN interconnect, in particular.

We examine some techno-economic aspects of LAN interconnect over ATM by applying selected charging schemes proposed by the CANCAN[2] consortium. (A number of European network operators are using charging schemes for ATM based on CANCAN proposals). The charging schemes are applied to some typical traffic scenarios which are based on traffic generated from the *OISIN* [3] LAN trail carried at LUND university, Sweden. This provides the basis for the data traffic patterns analysed in the paper. Typical traffic scenarios from this trial are established for CBR and VBR transfer capabilities.

We consider two different cases. First, we consider the case where traffic is charged according to the proposed CBR charging scheme (referred to as CASPIR 1.1a) as put forward by CANCAN. In this case a the main charging parameter is peak cell rate (PCR). The parameter which defines the traffic scenario is the ratio PCR/MCR, where MCR is the mean cell rate. In order to estimate the typical PCR/MCR ratio we use *OISIN* data. . The typical annual cost to the customer of sending 10 Mcells of data per day is derived for the trail data using price plan proposed in Walker, Kelly and Soloman (1997).

We also examine the case of moving LAN traffic to the nrt-VBR service category, namely, the VBR transfer capability. Here again traffic is priced using the charging scheme proposed by CANCAN for VBR LAN interconnect (referred to as CASPIR 1.1b within CANCAN). In this case, LAN traffic is charged on the basis of sustainable cell rate (SCR) and leaky bucket size. In order to apply the charging scheme we estimate a typical SCR/MCR ratio and leaky bucket size using OISIN trail data for a variety of sustainable cell rates. For each SCR chosen, a value of the leaky bucket that would need to be implemented to ensure no cells are discarded (or marked CLP 1) by the usage parameter control was estimated.

We then examine the implications for LAN traffic of the move from CBR to VBR and under what conditions any gain is likely to accrue to customer in terms of billing. The typical annual cost to the customer of sending 10 Mcells of data per day is derived for the trail data . The price plan from [Walker] for ABR and UBR are also considered in this context as are existing leased line tariffs.

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[2] Contract Negotiation and charging in ATM Networks. CANCAN is an ACTS project (Advanced Communications Technologies & Services), No. AC014 and is partially funded under the EU's research and technological development programme.

[3] Some ATM trails within CANCAN were named after Irish Mythological figures.

Printed and published by the IEE, Savoy Place, London WC2R 0BL, UK.

2. Techno-economic Aspects of CBR.

In the case of CASPIR 1.1a, the approach proposed by CANCAN for charging for CBR, a corporate enterprise needs to transport data between three or more remote LAN sites using a bearer ATM service offered by a public ATM network operator. The NO would be interested in knowing what monetary value to put on the tariff parameters and the nature of the revenue generated from CASPIR 1.1a. We develop a typical model of data traffic that is applicable to CASPIR 1.1a and look at the typical amount of revenue generated for the NO.

2.1 Charging scheme for Techno Economic Modelling

One of the principle activities within CANCAN is studying charging for ATM. This is done on a business case approach. Within this, a supplier is contracted to provide a given ATM service to a buyer. A detailed analysis is carried out of the service configuration and compatibility of the ATM service in question From this, the appropriate charging parameters for that service, together with tariff parameters, can be set out in a charging algorithm. Implementation issues for the proposed charging scheme are also investigated.

In the case of CASPIR 1.1a[4], a large corporate enterprise needs to transport data between two or more remote sites using a bearer ATM service offered by a public ATM network operator. Over this bearer service the corporate enterprise will be able to support a wide range of applications, including LAN interconnection over the CBR service category.

For this study we use a simplified version of the charging scheme proposed. We assume that only one *phase*[5] occurs in a given day. The only tariff parameter charged for is K. Thus the CASPIR 1.1a charging scheme can be set out thus:

$$C_i = K \times PCR_i \times t_i \qquad (1)$$

where the charging parameters are:

Parameter	*Symbol*	*Unit*	*Remarks*
Peak cell rate for phase *i*	PCR_i	cells/sec	Range: 1, ..., $4.29077*10^9$
Phase duration of phase *i*	t_i	sec	

Table 1. *Charging Parameters for CBR*

Tariff parameter for the charging scheme in equation (1) are:

Tariff parameter	*Symbol*	*Remarks*
Price per Peak Mcell	*K*	Argument: *PCR*, Mcells = 10^6 cells

Table 2. *Tariff Parameters for CBR*

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[4] A detailed exposition of CASPIR 1.1a can be found in the CANCAN Deliverable 9a: ' Final Report on Static Charging Schemes and their Performance', available from the European Commission, ACTS Central Office, DG XIII.

[5] A *phase* is that time period within which parameters remain fixed. This includes charging parameters (for instance, the requested peak cell rate), or a tariffing parameter (such as the charge per unit of time). Whenever one of these parameters changes value, a new phase is initiated. In contrast , a *session* is composed of one or more connections that are established and released. It is thus possible, that some connection exists only for a small period of time during a session. A connection is further structured as a number of consecutive phases.

2.2 Price plan

The price plan pertains to give values for various tariff parameters that appear in the charging scheme. In this case we need to find a suitable value for the tariff parameter, *K*.

CASPIR 1.1a is framed in reference to the CBR service class. We can base on our tariffs on those proposed by Walker et al. (1997) as set out below:

ATM Service Category	Price (US$/Mbit)
VBR	0.2
CBR	**0.1**
ABR	0.005
UBR	0.0002

Table 3. Wholesale Volume based ATM Charging Structure proposed by Walker et al. (1997)

Thus *K* is taken as $0.1Mbit, the charge per Mbit for the CBR service class. Given that there are 53 bytes in a cell, the charge per Mcell is $42.2

2.3 Demand Model

We now set out a data traffic senario demanded by the Large Corporate Enterprise (LCE) from the NO. We assume that a 10 Mcell dataload is exchanged between each of the corporations sites i.e each 'link' per day. The connection is assumed to be available 24 hours a day and the 10 Mcell transfer occurs entirely during that one phase. Thus the mean rate is 115.74 cells/sec.

2.4 'Typical' user bill for LAN interconnect traffic

We can now investigate how the chosen value of *K* impacts on a typical user's bill. As charging is related to peak rate rather than mean rate in the proposed CBR charging scheme, the next step is to choose a PCR that is sufficient to deliver the LAN traffic for the LCE. LAN traffic is quite bursty by nature and the PCR required will be significantly greater than the mean rate. The higher the peak cell rate chosen, the less buffering (and thus delay) is required, but higher PCR means a higher charge. Thus the user must trade off delay and cost requirements. We use data from the *OISIN* trial, carried out by CANCAN in 1996, to evaluate typical PCR/MCR ratios.

2.4.1 Typical value of Peak/Mean ratio (OISIN trail data analysis)

In order to establish typical PCR/MCR ratios we study some LAN traffic data from a CANCAN ATM trail. The *OISIN 1* trial recorded traffic on the interconnection using ATM of 10Mbit/s Ethernet LAN traffic between two Telia sites in Stockholm. Measurements were taken from 7/8/96 to 9/8/96. The mean cell rate was found to be 545 cells/sec and the value of peak/mean was found to be around 50. No shaping is imposed on this traffic, however, so the PCR measured is higher than what a commercial customer would buy. Figures 1 and 2 show the effects of moderate shaping on this ratio.

In the first case (Figure 1), the peak cell rate is averaged over 60 second intervals, roughly equivalent to buffering with a maximum delay of order 30 seconds. The typical peak/mean ratio is seen to be around 5.

In the second case (Figure 2), the peak cell rate is averaged over 300 second intervals, is roughly equivalent to buffering with a maximum delay of order 120-150 seconds. The typical peak/mean ratio is seen to be around 3.

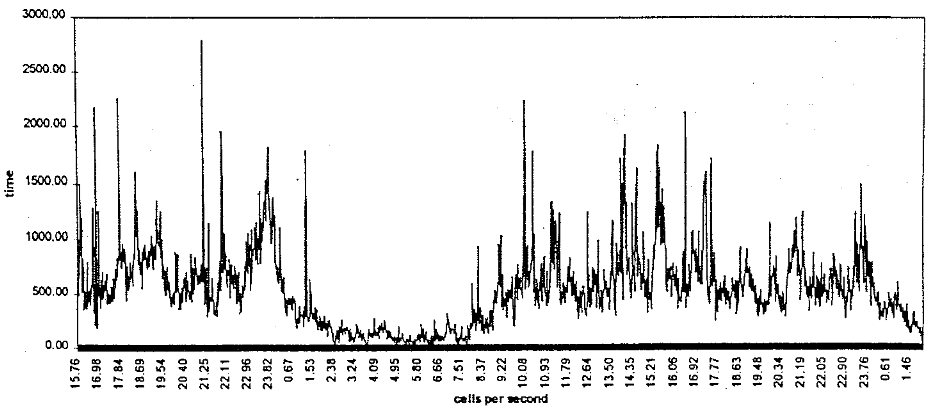

Figure 1: Impact of shaping on Peak/Mean ratio:
Averaging period = 60s; delay=30s (approx.); Total mean = 545.17 cells/sec;

Total peak = 2786.34 cells/sec; Peak/mean ratio= 5.11

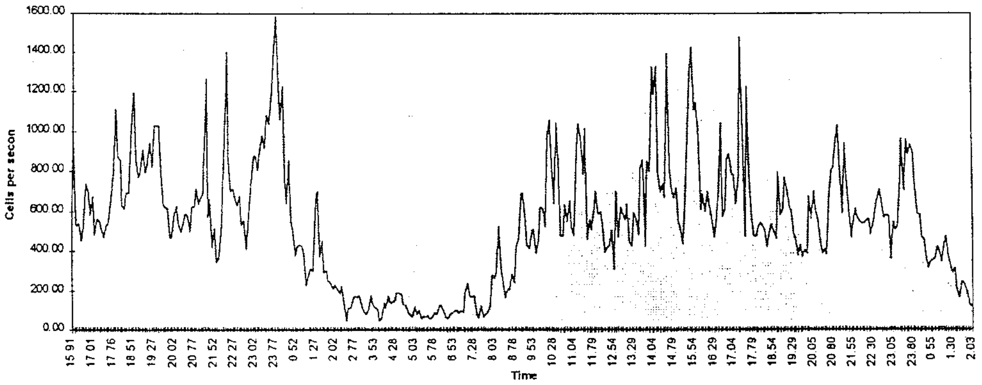

Figure 2: Impact of shaping on Peak/Mean ratio:

Averaging period = 300s; delay=150s (approx.); Total mean = 545.17 cells/sec;
Total peak = 1584.54 cells/sec; Peak/mean ratio= 2.91

2.4.2 Calculation of Annual bill (CBR):

Using the peak/mean values deduced from the trail data we can now proceed to examine the cost to the LCE, given the data traffic (10Mcell/link/day) and price that we have set out for the proposed CBR charging scheme. For *high-quality* LAN interconnect (infrequent delays of up to 30 secs.), the PCR should be about 5 times the mean rate. This would cost as follows:

$$C = K \text{ x } PCR_i \text{ x } t_i$$
$$= \$42.2 \text{ x } (5 \text{x} 115.74 \text{ x } 10^{-6}) \text{ x } (24 \text{x} 3600)$$
=$2110/link for 10Mcell/Day
=$770,145 / link for 10Mcell/year
= 670.026 ECU/ link for 10Mcell/year [6]

For *medium-quality* LAN interconnect (infrequent delays of up to 150 sec), the PCR should be about 3 times the mean rate. This would cost as follows:

$$C = K \text{ x } PCR_i \text{ x } t_i$$
$$= \$42.2 \text{ x } (3 \text{x} 115.74 \text{ x } 10^{-6}) \text{ x } (24 \text{x} 3600)$$
=$1266/link for 10Mcell/Day
=$462,087 / link for 10Mcell/year
= 402,015 ECU/link for 10Mcell/year

The annual cost per link to the LCE appears to be very high as set out above. This is mainly as a result of the price plan set out in Walkers paper et al. (1997), which is used as a basis for the tariff parameter.

From the customer point of view, the annual cost is probably too high when seen in terms of cost for a service given that cheaper alternatives are currently available. A 192k/sec. leased line could handle the 10Mcell/day traffic set out in the demand model above. Such a leased line would typically cost about 17,400 ECU ($20,000) per year over 250km. The reason for this gap is related to the charging plan for the CBR (DBR) rate of 0.1$/Mbit probably being struck relative to existing PSTN charges. In the case of LAN interconnect traffic over the CBR service class a more competitive rate for K would have to be found. In the *medium quality* case above, LAN example above, a rate of $0.004/Mbit would mean that this service could compete with typical leased line tariffs. This is closer to the rates for the ABR service class outlined in the Walker et al. (1997) paper, which it could be argued is more appropriate for LAN traffic.

	$0.1 per Mbit	$0.004 per Mbit
Delay: max. 30 secs	$670,026 (770,145 ECU)	$ 30,753 (26,755 ECU)
Delay: max. 150 secs	$402,015 (462,087 ECU)	$18,452 (16,053 ECU)

Table 4: Sensitivity of Annual Bill to delay

A network manager from a LCE could easily carry out a sensitivity analysis of an given annual bill to delay. From table 4, we see that for a price plan of $0.004/Mbit, a maximum delay of 30 sec would cost 26,755 ECU per year. A delay of maximum 150 sec would mean that the annual bill could be reduced to 16,053 ECU per year. Thus this sensitivity analysis approach means that a monetary value can be put on delay.

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[6] ECU per 1 US Dollar : 0.87. The exchange rates used as cited by the Federal Reserve Bank of New York at approximately noon (EST) on 15th May 1997.

3. Multiple LAN Interconnect over VBR.

An approach to charging for VBR has been set out by CANCAN in *CASPIR 1.1b*[7]. Here, again, a Large Corporate Enterprise (LCE) needs to transport data between three or more remote LAN sites using a bearer ATM service offered by a public ATM network operator. A NO would be interested in knowing what monetary value to put on tariff parameters and the nature of the revenue generated from *CASPIR 1.1b*, while a network manager in the LCE would be interested in knowing a typical annual bill for given traffic senario if he/she decided that ATM best suited their networking needs.

3.1 Proposed Charging scheme VBR.

The proposed CANCAN charging scheme for VBR may be given as:

$$C = (K \times SCR_i + N \times L_i^b) \times t_i \qquad (2)$$

The charging parameters for proposed charging scheme are given in Table 5 below.

Parameter	*Symbol*	*Unit*	*Remarks*
Sustainable bit rate for phase i	SCR_i	cells/s	Range: 1, ..., 4.29077*10^9
Phase duration of phase i	t_i	secs.	
Leaky bucket Size	L_i^b	cells	It equals MBS*(1-SCR/PCR), where MBS is the maximum burst size

***Table 5.** Charging Parameters for VBR*

The tariff parameters are set out in table 6:

Tariff parameter	*Symbol*	*Remarks*
Price per Mcell for SCR	K	Argument: SCR
Price per cell for L^b	N	Argument: L^b

***Table 6.** Tariff Parameters for VBR*

3.1.1 Estimation of Tariff Parameter, N.

We can now estimate N, the tariff parameter associated with the leaky bucket. The customer is charged for the SCR of his/her traffic using K x (SCR_i), as in equation 1. The additional charge for burstiness is captured in the N x (L_i^b) component of equation (1). Given the nature of LAN traffic, it is reasonable to assume that this additional charge should be such that the total charge is about half way between (K x SCR) and (K x PCR). As we are already

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[7] A more detailed account of *CASPIR 1.1b*, which is an approach to charging for VBR, can be found in the CANCAN deliverable 9a: ' Final Report on Static Charging Schemes and their Performance', available from the European Commission, ACTS Central Office, DG XIII.

charging at the SCR (K x SCR), then the leaky bucket tariff parameter is in addition to this. Thus the leaky bucket tariff parameter, N, may be derived thus:

$$N \times L = K \times (PCR - SCR)/2$$

$$N = K \times (PCR - SCR)/2L$$

N is calculated with reference to typical user traffic set out below. This is to ensure VBR is competitive with respect to CBR.

3.2 Price plan for VBR services

The price plan pertains to giving values for the various tariff parameters that appear in the charging scheme. Our price plan here is based on tariffs proposed by Walker et al. (1997), as set out in Table 6.

The price plan for *CASPIR 1.1a* (CBR) can be also applied in the case of *CASPIR 1.1b* (VBR). Only here the basis for charging should be sustainable cell rate (SCR) instead of peak cell rate. If we are looking for an alternative for the CBR service class, it would be useful to use that same rates per Mbit to examine the potential benefits to the customer from moving from the CBR service class to VBR service class. The charge for the customer should be lower if the switch to VBR is made with some buffering of traffic. If we employ the same rate we can seek to isolate this benefit to the customer and focus on the role of the charging parameters. So for CBR the charge is \$0.1/Mbit or \$ (0.1 x 424)/Mcell.

3.3 Impact of the selected price plan on typical user bill for LAN interconnect traffic

We now examine how the values of *K* and N impact on a typical user's bill.

3.3.1 Typical values of SCR/Mean, and L/Mean ratios (OISIN data analysis)

We need to find typical SCR/mean ratio and Leaky Bucket size. A series of experiments were carried out on the OISIN 1 data for a variety of sustainable cell rates. For each SCR chosen, a value of *L* was found such that *L* is the minimum size of the leaky bucket that would need to be implemented to ensure no cells are discarded (or marked CLP 1) by the usage parameter control (UPC). Results are shown in Table 7 and graphed in Figure 3.

SCR	SCR/mean	L	L/mean
900	1.65138	811083	1488.23
1100	2.01835	326415	598.927
1300	2.38532	153722	282.059
1500	2.75229	135338	248.327
1600	2.93578	126180	231.523
2000	3.66972	90543	166.134
4000	7.33945	38683	70.978
6000	11.0092	16355	30.0092
8000	14.6789	9910	18.1835
10000	18.3486	7074	12.9798
12000	22.0183	6472	11.8752
14000	25.6881	6344	11.6404
16000	29.3578	6219	11.411
18000	33.0275	6033	11.0697
20000	36.6972	5908	10.8404
22000	40.367	5783	10.611
24000	44.0367	5658	10.3817

***Table** 7. Ratios for SCR/mean and L/mean*

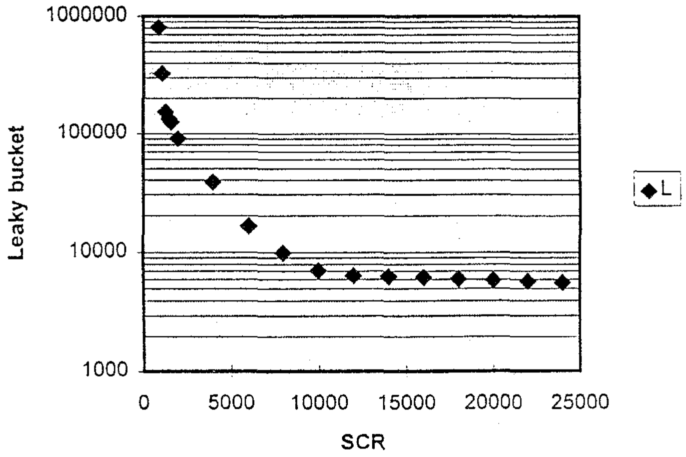

***Figure 3**: Leaky bucket (L) vs SCR (log-linear scale).*

It can be seen from the data that there is a trade-off for the user in choosing suitable values of SCR and Leaky Bucket Size, L, both of which are traffic parameters. For the purposes of this study, we want to set the VBR tariff parameters to be such that a user's total bill for VBR is cheaper than his bill were he has to use CBR with some traffic shaping (see section 2.4.1). Keeping delay to a low value (~30 seconds max.), the PCR required here for delivery of the same traffic is about 5 times the mean rate. Thus, to set a value for tariff parameter, *N*, we select a "medium" value of SCR = 2.75*mean. This SCR is roughly 55% of the peak rate. The corresponding value of L is 248.2*mean.

3.4 Demand model and Calculation of N

We need to consider the SCR and L for a typical user's traffic before calculating *N*, the tariff parameter for the leaky bucket. We assume that a 10 Mcell dataload is exchanged over each site link per day. The connection is assumed to be available 24 hours a day and the 10 Mcell transfer occurs entirely during one phase. Thus, again, the mean rate is 115.74 cells/sec.

Following from 3.1.1, N can be calculated thus:

N= K x (PCR -SCR) / 2L

= 42.4 x (5*mean - 2.75*mean) / (2 x 248.2 x mean)

= $0.192/Mcell/sec

3.5 Calculation of Annual Bill for Customer (VBR)

The customer must trade off SCR and leaky bucket size, L. Bills are produced here for a number of options (chosen from Table 7)

The calculations below relate to a 10Mcell/day dataload, with a mean cell rate of 115.74 cells/sec.

3.5.1 (Case 1) High SCR

SCR = 3.67*115.74 = 425 cells/sec (approx. 75% of peak)

L = 166.13*115.74 = 19228 cells

This would cost as follows:

C = (K x SCR x t) + (N x L x t)

= $(42.4 \times 425 \times 10^{-6} \times 24 \times 3600) + (0.192 \times 19228 \times 10^{-6} \times 24 \times 3600)$

= 1557 + 319

= $1876/day/link

= $684,740/year/link

= 595,724 ECU/year[8]

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[8] ECU per 1 US Dollar : 0.87. The exchange rates used based upon US dollar rates as cited by the Federal Reserve Bank of New York at approximately noon (EST) on 15th May 1997

3.5.2 (Case 2) Medium SCR, Higher L

SCR = 2.75*115.74 = 318 cells/sec (approx. 55% of peak)

L = 248.3*115.74 = 28738 cells

This would cost as follows:

C = (K x SCR x t) + (N x L x t)

= (42.4 x 318 x 10^{-6} x 24 x 3600) + (0.192 x 28738 x 10^{-6} x 24 x 3600)

= 1165 + 477

= $1642/day/link

= $599,330/year/link

= 521,417 ECU/year/link

3.5.3 (Case 3) Low SCR, Higher L

SCR = 1.65*115.74 = 191 cells/sec (approx. 33% of peak)

L = 1488.2*115.74 = 172244 cells

This would cost as follows:

C = (K x SCR x t) + (N x L x t)

= (42.4 x 191 x 10^{-6} x 24 x 3600) + (0.192 x 172244 x 10^{-6} x 24 x 3600)

= 700 + 2857

= $3557/day/link

= $1,298,305/year/link

= 1,129,525 ECU/year/link

3.6 Does it pay to move to VBR?

We have looked at a cost senario for CBR and VBR involving the same data traffic per day and based on the same price plan. The data in the CBR case used an input buffer for the data traffic; this buffering was done to keep the PCR to an economical level. In the second case under study , namely VBR, no input buffering is performed but a leaky bucket is used to control maximum burst size. We compare the costs of using each of the service categories.

In section 2.4.2, for CBR, a PCR 5 times the mean rate leads to an annual charge of 670,026 ECU per year. With the selection of VBR under CASPIR 1.1b, the charges in Case 1 (595,724 ECU) and Case 2 (521,417 ECU) are lower. Thus the customer may benefit selecting VBR over CBR. In Case 1, the SCR chosen was 3.67 times the mean (resulting in a leaky bucket size of 19228 cells to prevent overflow). In Case 2, the SCR chosen was 2.7 times the mean (resulting in a leaky bucket size of 28738). However, charging for VBR is sensitive to the SCR and leaky bucket values chosen, as can be seen from Case 3. Here the charge for CBR (670,026 ECU) is below the VBR charge (1,129,525 ECU) for the charging parameters, SCR and L, chosen.

However, it should be kept in mind that there is no delay within the VBR service class, so direct comparison with the CBR service class should be treated with caution. Also, the choice of value for tariff parameter N is based on a study of data from a single trial. It should be kept on mind as well that the method of choosing N may need some refinement.

This highlights the need to further study data from field trials and model the sensitivity of charges to a change in the relevant charging parameters.

It would be instructive to compare the annual bills above to current ATM prices. The example prices are the proposed ATM charges of a major European operator (The company is not named for reasons of confidentiality). The quoted tariffs refer to nrt-VBR only, which is suitable for LAN traffic. The proposed tariff in table 9 include of an installation and rental charge. The installation tariff consists of an access and PVC set up charge. The rental charge entails an access charge (PCR related), a network charge (which is SCR related) and a service interface charge.

The rental charges are given for 25% SCR, 50% SCR and 75% SCR. The prices reported in table 8 are for a peak cell rate of 17.6 Kbps. Installation charges are a once off charge and are ignored.

	25% SCR	50% SCR	75% SCR
ECU cost/link/yr.	74.217	89,375	124,736

Table 8. *Proposed Market ATM Prices for nrt-VBR by Major European Operator*

3.8 Comment

A comparison of the proposed annual market ATM charges for nrt-VBR show that there is a considerable gap between the proposed tariffs reported in table 8 and even the lowest VBR charge from our model. Part of this gap may be explained by the fact that the Walkers et al. (1997) price plan, which was used as the basis for these calculations, was devised with real time applications in mind rather than non real time, as is the case with the charges in table 8. An example of a more competitive price plan for nrt-VBR, based on the buffered traffic in case 2 above, would entail setting K around the order of $6/Mcell and N in the region of $0.03. However, it should be remembered that the price plan used here is based on the Walkers et al. (1997) proposed tariffs for CBR. Given the nature of LAN traffic, UBR could be used instead of CBR. Walkers price plan sets UBR at a level ($0.0002/Mbit) which is 500 times cheaper than CBR. A dataload of 10Mcells a day would cost 269ECU ($309) per year using Walkers proposed UBR tariff. Given that ATM charging appears to be converging toward price plans based on service class (CBR, VBR, ABR, UBR) consideration should be given to whether customers will be given the freedom to move a given traffic type from one service class to another. This issue has important implication for the revenue generated from ATM.

4. Conclusions

In this paper we examine some techno economics aspects of ATM charging schemes for the CBR and VBR service categories, as proposed by the CANCAN consortium. We examine the some economic aspects of traffic management within ATM and the roll of service categories in determining the final bill. The paper shows:

- examples of annual bills for ATM which are arrived at by analysis of historical traffic data and the application of a price plan to a given charging scheme.
- that it is possible to put a monetary value on delay by using a sensitivity approach.
- the Walker et al. (1997) price plan for CBR may not be appropriate for LAN traffic.
- that alternative price plans can be devised in the context of substitute technologies.

The paper also opens wider questions that would be of interest to both corporate network managers and network operators:

Network Managers

Given that the price plans for tariff parameters are outside the control of network managers, except say, where there are negotiated discounts and special deals available from the network operator, a network manager must focus on the control of charging parameters in order to reduce network bills. For the CBR service category, this would mean keeping the PCR to the lowest possible value, subject to delay considerations. An analysis of historical or similar traffic patterns would need to be carried out to examine the burstiness of traffic and gauge how this can best be achieved

In the case of VBR, there is a trade off between SCR and leaky bucket size. This must be given careful consideration in order to make sure bills from the network operator for network usage are kept to an minimum. The nature of this trade off is traffic specific and again the network manager would have to consider the nature and characteristics of the traffic he/she would wish to send over a network.

If a network operator only offers data carriage, rather than specific services, then the choice of ATM service category will have to be made by the network manager. Apart from technical considerations (delay, QoS needs), economics will be a factor here. If a network manager can meet data transfer requirements by using a service category which has a lower price plan (e.g. in terms of $ per Mbit) and thus lower subsequent overall bill, then he/she will probably attempt to do so.

Network Operators

This study highlights the fact that a network operator may have to consider the following:

(i) whether to design usage based price plans on the basis of service category (CBR, VBR etc.) or on the basis of service (e.g. voice).

The striking of price plans for tariff parameters for the tariff parameters by service providers is not a straightforward issue. Prices for tariff parameters need to be considered not only in a way that makes ATM attractive relative to substitute technologies but also in relation to service categorised within ATM.

(ii) whether to allow the customer to move a given traffic between service categories.

If usage price plans differ for ATM service categories, then this freedom to corporate network managers could a important implication for revenue generation.

Glossary

ABR	Available Bit Rate
CBR	Constant bit Rate
CS	Charging Scheme
LCE	Large Corporate Enterprise
NO	Network Operator
MCR	Mean Cell Rate
PCR	Peak Cell Rate
SCR	Sustainable Cell Rate
UBR	Unspecified Bit Rate

VBR	Variable Bit Rate

References

Walker D, Kelly F P, Soloman J: "Tariffing in the new IP/ATM environment", Telecommunications Policy, Vol. 21, No 4 pp 283-295, May 1997.