Using a long-term cost-allocation approach for calculating reliable pricing-margins

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Abstract

In a highly competitive market, such as the telecom-market, the tariff set for a new service will have a huge impact on both market share and revenues. Moreover, taking into account the possible impact of customer-perception, it is nearly impossible to raise prices of a service in a later stage, which means that setting your initial price too low might either jeopardize your profits or your market share (in case you do raise the tariff later on). On the other hand, setting the initial tariff too high or even postponing the introduction will reduce your competitive advantages over other service providers, at least in the early stage, and might thus impact your market share. In this paper we show that we can derive important information about the sustainability of a tariff through the use of a bottom-up cost calculation and allocation approach. We will describe such an approach and explain why this method should be used as opposed to other methods. We also show the positive effect that the introduction of a new service might have on the profit-margins of other services and how to quantify this effect using the proposed method. Finally we use the proposed method to determine a good pricing scheme in a realistic case where an iDTV service is introduced in a network mainly carrying broadband internet traffic. In this case study we also show in which way the results will vary with the considered forecast-term and indicate that a long-term calculation will give more reliable results.

Introduction

The process of setting a tariff for a certain service is a difficult problem, especially when considering the introduction of a new service on the market. The tariff set for the service might have a huge impact on the telecom company, since in the highly competitive telecom-market of today, services typically have a low elasticity. This means you should avoid raising your tariff in the future because it would have a significant negative impact on your market share. As such, setting an optimal initial tariff for a new service is crucial yet complex: if it is set too high, this might result in a lower take-up of market share, while setting it too low might result in a unsustainable situation. Even though it might be a strategic decision to take a small loss in order to gain market share very fast, it is still very important to have an idea of a sustainable tariff for the service.

Within the process of pricing the service provider has to make several important decisions. First the service provider can decide which pricing scheme he will use for the considered service. Several pricing schemes and variations are detailed in the literature [1], [2], [3].

While the pricing scheme is very important for the marketing of the new product, setting the actual tariff charged, regardless of the pricing scheme used is more important from the company's profitability point of view. Making this decision relies on a lot of information in which the company tries to model the reactions of the different players in the field. The following players can be identified (non-exclusive):

- *The customers* will buy the new service or a competing service depending on the tariff proposed. Their buying behavior is usually retrieved through the use of market research.
- *The competition* is selling similar services. Accurate information about the competition is hard to get and the interpretation of this information involves knowledge of their strategic background.
- *The regulator* tries to maximize consumer surplus and might, from this point of view, impose regulations on the considered tariff.
- Finally, *the company* tries to maximize their profits and turnover, especially in the long run. In this light, costs and revenues are important as well as the strategy the company pursues.

Before turning to game theory or another method for calculating an optimal solution of the problem, it is possible to define indicative margins on the tariff using information of the (forecasted) cost of this new service. Since all services are provided over the same network, the costs per service of using this network are not easily retrieved. The margins which can be calculated without taking this sharing into account, give only limited information. By using a bottom-up cost-allocation approach more indicative margins can be calculated giving additional information about the sustainability of a tariff. It is also important to calculate these costs on a longer term, since short-term effects could influence the resulting margins. Especially when introducing a new service over the network, initial effects on the customer adoption will have a large influence on the costs calculated, and costs should be calculated once the new service moves to a steady growth.

The remainder of this paper is structured as follows. Section II gives a background on cost-calculation and allocation for network-services and shows which pricing-margins can be deduced from these costs. In section III these margins are related to each other in the scope of a realistic use case in where an iDTV service is introduced

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over an existing network in which a broadband internet access service is already provided. Finally Section IV provides a general conclusion and future work.

Calculating pricing-margins

A service is profitable when the total revenue of all customers covers all costs incurred for delivering this service to these customers. Since the network-resources are shared amongst different services, these costs are the result of a cost calculation and allocation process. From these costs, pricing margins can be calculated, giving an indication of how low a tariff can be set and whether the tariff set is sustainable.

Cost calculation and allocation

In a converged network, the available bandwidth is shared amongst all different services over this network and several different services might require a bandwidth increment at the same time. This allows major savings due to economy of scale and scope, but requires a cost-allocation process to determine the cost attributed to each of the different services. Depending on the different cost bases, different costs per service can be revealed. Dependent on the considered starting point of the network modeling process, two approaches can be followed for allocating costs to the different services: top-down and bottom-up cost modeling.

The first approach, the top-down method, starts from the existing network infrastructure. In this case, the actual network dimensioning is a result from fluctuations in historic and current demand. The network is therefore less efficient than a new network. The cost of existing equipment is allocated to the elements needed to deliver the service, through the use of cost drivers [4]. Therefore, an accurate identification of real cost drivers is required. In practice, it might be difficult to select the correct driver, leading to less efficient and less fair allocations. Two important cost bases can be distinguished for the top-down valuation of equipment.

Historical Cost Accounting (HCA) uses the asset purchase costs as book value, taking depreciation into account. Since this method counts all historical costs, it does not lead to an optimization of the network-resources and can not be used in case of a new service.

Current Cost Accounting (CCA) values assets at the current market price. This cost base represents the replacement cost of an asset. However, as a result of the continuous evolution of technology, it is not always possible to find the same equipment on the market as what has been installed in the network previously. A possible solution to this problem is given by the Modern Equivalent Asset (MEA) cost base, where the costs of equipment is valued using the cost of new technology offering the same (or more) functionality as the one currently installed.

The second approach, the bottom-up method, requires as starting point the demand for the services. Both a forecasted demand for new services as for existing services can be used here. The network is dimensioned in such way that it is optimal for the current situation: it can serve all customers with the requested services at the proposed quality of service. Service costs are allocated according to their required network equipment and usage.

In the bottom-up method, the company's properties and goods will be evaluated following the forward looking cost (FLC). When considering a new network this means that only new and efficient technology will be used. When modeling an existing network, on the other hand, it might mean that less expensive technology is used in the study. This implies that the current network must be reconsidered and remodeled. There are three approaches for doing so: the scorched earth (green field), scorched node (path dependent) or incremental node approach. In scorched earth, the network is redesigned with as few constraints as possible: a different number of nodes, a changed topology and other technological solutions can be taken into account. Both other possibilities make a more fair compromise between efficiency of new technologies and networks and the existing network structure. The nodes stay at their original positions. In scorched node all equipment in the node can be changed, whereas in incremental node the existing equipment in the node is kept and expanded [5].

With the introduction of a new service in the network only bottom-up cost-allocation can be used and any existing resources used in the network should at least be allocated using current cost (MEA) or even FLC. With an incremental design of the network for the introduction of a new service in the network and for providing the increasing bandwidth-requirements of the existing services, scorched node or incremental node will reflect best the actual situation.

Cost-allocation

All costs calculated can be further divided in direct costs, shared costs, joint costs and common costs. Note that since there is no consensus in literature concerning the precise definition of shared and joint costs [4],[5], we adopt the definitions given above in [6]. Once all costs have been categorized and assigned, different types of costs per service are calculated through different methodologies (see Fig. 1).

The first method is the Stand Alone Cost (SAC). It considers the cost per service as if there was only one service offered. In this case all costs are direct costs and allocated to that service. The SAC is the highest cost level the service can reach. This method is only used in a top-down approach to determine an upper bound for the cost of a service.

The Fully Allocated Cost (FAC) method allocates all costs to all services. Direct costs are directly attributed to each cost consuming service, shared/joint and common costs through cost drivers. This method can be used for top-down as well as bottom-up approach. The hardest part when using this cost-base is to find the right allocation key for all costs. For instance the algorithm described in [6] can be used.

The *(Long Run) Incremental Cost ((LR)IC)* method only measures the change in total costs when a substantial and discrete increment or decrement in output is generated. This

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increment can be a newly offered service, but also an increase in output of one service. Economies of scale will be playing an important role in the allocation of shared/joint cost, resulting in a smaller part of attributed costs than in FAC. The LRIC method is mainly used in the bottom-up approach.

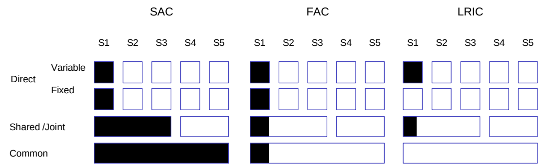

Fig. 1: Different methodologies for allocating costs

Unitary cost-margins and effects on existing services

Fig. 2 gives an overview of the different margins which can be identified according to the cost-information available. By using the results of cost-allocation, the margins can be refined which gives more information and will be important in case other parameters such as customer demand or competition pricing force the price between the break-even price and the stand alone cost.

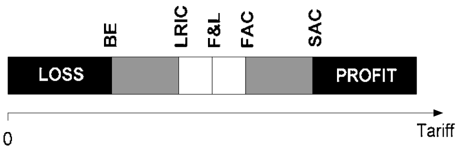

Fig. 2 Overview of different cost-margins

Outer margins

The two outer margins on the tariff of the new service can be easily defined using only the forecasts and simple economic calculations. These two margins will only give a clear indication whether the proposed business scenario will result in a certain profit or in a certain loss evolution.

Break-even

The break-even calculation of the services over the existing network gives a minimum-margin on the tariff to charge to the customers of the new service. This should be interpreted as the tariff under which losses are sure. In this calculation the minimum expected revenue is calculated as the difference between the summation of the costs of all services over the network and the (forecasted) revenue of the existing services as shown in Eq. 1.

It is clear that this is not a sustainable cost and will result in loss when the amount of customers is higher than forecasted. This margin should therefore be used as an absolute minimum margin; beneath this margin the service cannot be provided.

$$margin_{BE} = \frac{cost_{tot} - \sum_{s \in Existing\ Services} revenue_s}{\#customers_{forecast\ new}}$$

Eq. 1 Calculation of the break-even margin

Stand-alone

The stand-alone calculation for the new service over the existing network gives an upper margin, which should be interpreted as the tariff above which profits are sure (in case the forecasts are correct). In the stand-alone calculation the tariff is set at such level that all costs made for introducing the new service are covered, when these costs are calculated stand alone (as if no other investments in network-architecture happen at the same time). This is in line with the SAC cost allocation approach as discussed above.

$$margin_{SAC} = \frac{cost_{new\ without\ existing}}{\#customers_{forecast\ new}}$$

Eq. 2 Calculation of the stand alone margin

Narrowing down

Working between the two previously defined margins requires a closer knowledge of the actual costs for providing this new service to the customers. In order to narrow down these margins, we focus on the impact of two effects:

1. Calculating the costs of introducing the new service using only the investment costs in the first year might give unreliable costs (either too high or too low). Customer-adoption of the new service does not follow a linear increase, but is usually defined by an innovation adoption curve of Rogers. Costs of equipment will also have a specific evolution over time.
2. Within a converged network all services are using the same equipment of the network. This allows large cost-reductions due to economy of scale and scope. A more realistic cost of the service can be calculated using a cost-allocation method.

Two different cost-allocation methods are best suited for this calculation and result in a refined upper- and lower-margin. A combination of both can be used for narrowing down even further.

Margin based on FAC

The FAC-margin reflects the situation in which each service is paying the network resources it uses, regardless of the fact that it might actually be filling spare capacity of other services. All investment costs are allocated using a fair cost-allocation scheme which reflects the actual usage of the resources available in the network. A cost-allocation scheme as discussed in [6] can be used for the allocation of all shared network costs.

Margin based on (LR)IC

The LRIC-margin reflects the situation in which the new service is at each moment seen as an additional service on top of the main service(s). The costs allocated to the new service are equal to the additional investment-costs necessary to provide the service when the cost for providing the increment for all existing services is already committed.

Margin based on combination of LRIC and FAC

Considering the adoption curve of a new service, it is clear that in an early stage it resembles most closely the LRIC situation of a very small service using mainly spare capacity of the existing services. In a later stage of its adoption it will possibly grow at a size justifying the use of FAC. A margin can be defined using a combination of both, by setting a threshold level on the capacity and using LRIC as long as capacity-requirements for the new service stay beneath this level and FAC when the capacity requirements are above this level. Using such method might also give the new service a more competitive edge without pushing the existing services in a non-profitable situation.

Case-study – introduction of iDTV

In order to get an idea of the relative difference of these considered margins, we have calculated all considered margins for a realistic case. In this case we consider the introduction of a new 'iDTV'-service over an existing network with an existing internet broadband access service (referred to as 'BB' in the remainder of this paper). The iDTV-service considered will offer at least digital channel broadcasting and VoD.

Forecast

Making a good forecast for introducing a new service over a network and for the existing services over this same network lies outside the scope of this paper. Since such figures have a high strategic value for a telecom company, it is nearly impossible to acquire accurate and consolidated forecasts for such case. In spite of this, it is still possible to acquire some data and by making grounded assumptions retrieve a more or less realistic forecast.

Since all costs of capacity are directly driven by the customers, this is also used as the starting point for the forecast. We made use of the adoption curve as defined by Rogers for modeling the evolution of both customer-bases. Historical data for the existing BB service could be easily retrieved from the annual reports from the considered telecom-company [7]. For iDTV, it is much more difficult to formulate correct forecast numbers. We started from a market analysis in Belgium, conducted by the University of Ghent, concerning this matter [8] and [9]. The growth is corresponding to the growth found in [10] considering that the growth is topped due to the limitations of the customer base. We estimated that the adoption of iDTV will be faster than the adoption of BB, due to the existing high penetration of TV, the easy conversion and the use of triple play as a marketing strategy for introducing the digital television to the existing BB customers and new customers. We expect both adoption curves to merge in the future (2015).

Following this assumption we constructed the most likely adoption curves for both existing BB and iDTV. Fig. 3 shows both adoption curves, indicating with void markers the part of the curve for which values could be found in the literature as described above and with filled markers the extrapolated part of the curve.

We also expect the maximum bandwidth available per user to change in time as well. Historical figures of this bandwidth for BB can be found in the same annual reports as before [7]. Illustrative figures of this bandwidth-evolution for iDTV were found in [11]. We extrapolated these numbers assuming that the total bandwidth requirements for iDTV equal those of BB in 2009 and that both will not divert from each other afterwards.

The combination of both the increase in bandwidth and in number of customers gives us increasing bandwidth requirements in the network as is shown in Fig. 4.

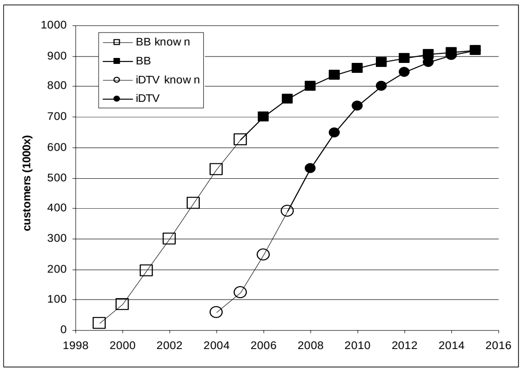

Fig. 3 forecasted adoption curves of iDTV and BB

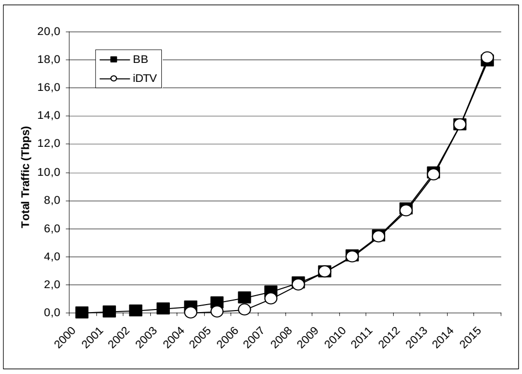

Fig. 4 forecasted capacity-evolution for iDTV and BB

Finally for calculating the costs, we considered the initial costs to be proportional to the amount of bandwidth that is additionally installed in the network. Since realistic cost figures could not be found we set the cost of incremental investment for the period 2008-2009 equal to 10000 units. These initial costs are further adjusted to reflect the effects of economy of scale (EOS), cost-erosion of the considered material and, since this case can be seen as a special case of investment analysis, net present value (NPV). The factor used for EOS is taken from traditional SDH-networks where a quadrupling of the required capacity results in a cost which is 2.5 times higher [12]. This corresponds to a cost-increase of approximately 8 for a capacity-increase of 25 which lies between the cost-increase of 6 and 10 as mentioned in [14] and deduced from [13]. Cost-erosion is assumed to be an exponentially decreasing function in which costs decrease with 10% every year which resembles closely the cost-erosion model proposed in [15] and [16]. Finally the interest rate for calculating NPV is set to 10% as well.

Pricing and effects on existing services

From the forecasted cost-evolution, the different cost-margins can be calculated. Since in the forecasts of this case, only the costs of the installed and shared network-capacity are calculated, the cost-allocation only takes these costs into account for the calculations.

<u>Outer margins</u>

In case of the stand-alone cost only the cost of the iDTV should be calculated as if it were the only service over the network using the same effects as described above. It is clear that, due to the effect of EOS, the sum of the costs of BB and iDTV both calculated as stand-alone will be larger than the cost of providing both over the same network.

In case of the break-even cost, the revenue of BB should be known. Two different solutions for calculating this value are considered:

1. The yearly revenue for BB is set at a value which guarantees a predefined profitability (expected profit (EP)) of the service (as stand-alone (SAC)).
$$Revenue_{tot} = \sum_{years} SAC_{year} \cdot (1 + EP)$$
2. The tariff (T) charged to the customers (C) of BB is set at a constant value which guarantees a predefined profitability in a predefined year (y).
$$Revenue_{tot} = \sum_{years} Tariff \cdot Users$$
$$Tariff = {SAC_y \cdot (1 + EP)} \big/ {Users_y}$$

<u>Narrowing down</u>

As described above, the margins calculated before can be narrowed down by using different cost-allocation schemes. In the following calculations the combination of FAC and LRIC makes use of a threshold value of 20% meaning that all costs are allocated using the LRIC allocation scheme as long as the bandwidth-requirements for iDTV stay below 20% of the total bandwidth requirements.

The result of the calculation of the different margins is shown in the following figures. The different allocation schemes used are: stand-alone cost allocation (SAC), fully allocated cost (FAC), long run incremental cost (LRIC), combined FAC and LRIC (FAC/LRIC), break-even using a predefined profitability per year (BE cost), break-even using a predefined tariff (BE cust). In the case of break-even calculations, the profitability expected is set at 10% and the year at which the tariff is calculated is set at 2002. Since all costs in the calculations are coupled to unitary costs, all results are indicated as a function of these unitary costs (U).

– Fig. 5 shows the evolution of the cumulative of the yearly investment costs allocated to iDTV.
– Fig. 6 shows the evolution of the pricing margins of iDTV indicated by the tariff charged per customer.

As said before, the specific allocation scheme used for calculating the cost-margins of iDTV will have an impact on the costs and on the pricing margins of the existing services. Fig. 7 shows the evolution of the pricing margins of BB when the cost-allocation schemes are used for calculating the part of the costs allocated to iDTV.

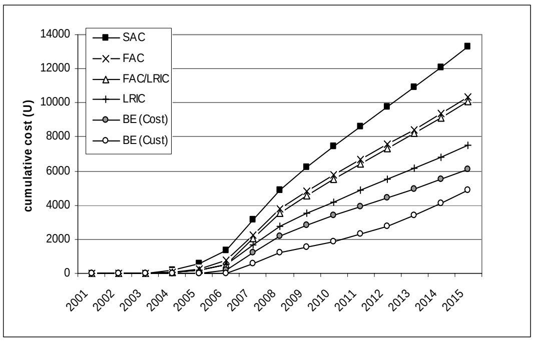

Fig. 5 Cumulative cost of iDTV

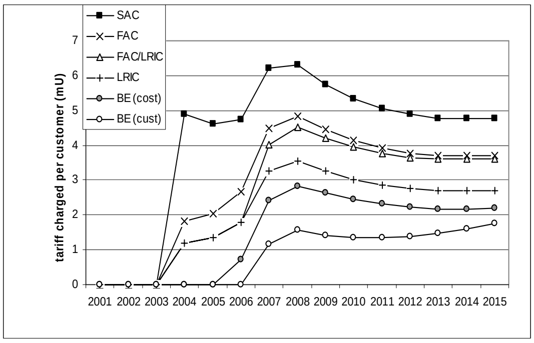

Fig. 6 Pricing margins per customer of iDTV

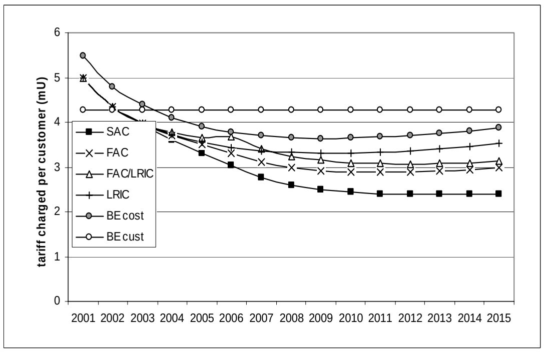

Fig. 7 Pricing margins per customer of BB

Interpretation of results

When using long-term forecasting and narrowing down the pricing margins, large differences can be found in the resulting pricing margins. The different figures show that the margins calculated using a cost-allocation approach give more competitive margins than the stand-alone cost can give while staying well above the BE-margin in which the sustainability of the tariff can not be guaranteed.

From Fig. 6 it is clear that in the first years after the introduction of the new service, the margins are not steady, while once after 2011 the margins move to a steady state. Using the margins from a study over the first years of iDTV (up to 2006) will give a non-sustainable price, and using only a moderate term (up to 2009-2010) might give a non-competitive price. Using the combination of LRIC and FAC eliminates this effect and gives a more reliable price over the most considered periods, although for the very early years it will stay far below actual costs.

Fig. 8 shows that the narrowed down margins are between 60% and 70% of the stand-alone cost margin, and are at least 10% above the highest BE-margin and up to 50% above the lowest BE-margin.

Finally it is also clear from Fig. 7 that using these margins for iDTV leaves more possibilities to lower the prices on the BB service as well. It also shows that, as all competitive margins (non-BE) are close to each other, using the combination of LRIC and FAC does not place additional stress on the BB-service.

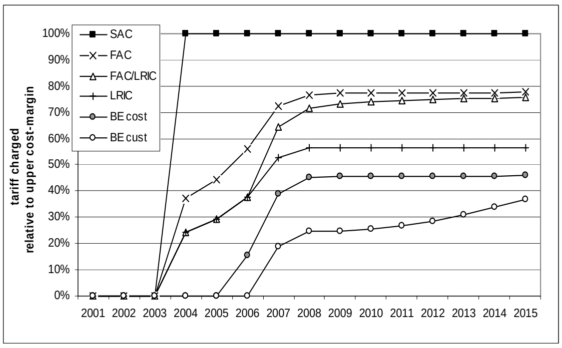

Fig. 8 Evolution of the tariff charged for iDTV in relation to the maximum cost-margin.

Conclusions

Setting a tariff for a new service over an existing network is a difficult problem, in which information of the investment costs can be used as valuable input. The outer margins, calculated using break-even or stand-alone cost-allocation give an indication whether a tariff will result in sure loss or sure profit.

Between these two margins a grey zone exists. In this paper we presented an approach based on bottom-up cost-allocation which can be used for narrowing down this zone and gathering additional information in this zone. Additionally we indicated how a long term planning will enhance the reliability of the results by discarding the possibly large cost variations during the initial phase of the new service.

We also performed a realistic case study in which the impact of this approach was studied. By using cost-allocation on this case, the upper margin could be refined to 70% of the original margin (FAC) and the lower margin indicating a sustainable price was found about 50% above the lowest original margin.

We found that, due to EOS, introducing a new service over the network also reduces the cost on the existing service(s). In our case the different proposed alternatives allowed a substantially lower tariff on the existing service than in case the new service is not introduced.

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