Mobile Multimedia Services: Value matters

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Abstract--**Mobile communication technology has evolved over the years to support a wide range of multimedia services, besides the traditional voice service. This evolution has also created new challenges for the mobile industry in the way it does business. Profitable business and pricing models seem to be elusive thus far. In this paper, we emphasise the need for a value-based approach for pricing a service vis-à-vis the volume-based models that are widely in practice today. We highlight the benefits of a value-based pricing model for different types of services, and study the impact of this model on the transport-content interface in a mobile value chain. Ramsey pricing and i-mode's pricing strategies are revisited in this regard. Role of competition and market uncertainty in our model is also discussed. We also discuss the impact of a value-based pricing model on the future mobile technology evolution (traffic forecast, Quality of service) and other issues that may have to be taken care of for such a pricing model to be implemented.**

Index terms--**multimedia services, value-based pricing model, vertical bundling, mobile value chain, quality of service (QoS) in networks.**

I. INTRODUCTION

The availability of multimedia services on mobile phones is no longer a myth. However, the major impediment to service rollouts seems to be the absence of suitable pricing and business models. This has largely been due to the evolution in bearer technology, enabling the introduction of a range of services resulting in the entry of new players and additions to the mobile value chain. The advent of packet-based IP technology has added new levels in mobile value chain [1]. The pricing models changed from time-based to volume-based. The i-mode model is a very good instance of a volume-based pricing model, where the majority (85%) of its revenue was generated from the volume of data usage [2]. However, does this volume-based pricing model capture the exact value of a service? Or does this lead to cannibalising a service's demand? Wouldn't a volume-obsession at the transport level add greater load on the network thus leaving the network resources over-utilised and the network designers guessing on the future traffic levels? Can a value-based approach combined with Ramsey pricing [3] act as a solution for the changing mobile services paradigm? Is vertical bundling a better solution? These are some of the issues, which we try to address by recommending a value-based approach to the pricing of multimedia services thus providing greater independence of the value of a service from the underlying technology. This bundling of content with the transport is also known as vertical bundling.

Value-based pricing or perceived-value pricing [4] is a pricing model which sets the price for a service or product based on the perceived value of a customer unlike other pricing models which are based on cost, competition etc.

By adopting a value-based approach, new revenue sharing models need to be deployed at the transport-content interface. We use the term consumer, customer and subscriber interchangeably in this paper. Also, by price we mean the charge paid by the consumer for one unit of usage, whereas tariff means a complex function that includes price and other measurements associated with a service. For instance, two-part tariff having a monthly fixed-charge and a usage-based price.

In section II, we give an overview of the basic pricing dynamics in a mobile market and show why a value-based approach is required. Different categories of multimedia services are looked at in this regard. Next, we discuss the meaning of value-based pricing of services in section III. In order to implement the value-based approach, new revenue sharing models need to be deployed at the transport-content interface. We discuss this in section IV. The case of the highly successful i-mode services, focusing on the relationship of the transport and content is discussed. We compare this case with a vertical bundling approach explained in section III. Section V discusses the role of competition as a balancer in our model and section VI mentions the role of market uncertainty. In section VII, we discuss the impact of the value-based pricing model on the bearer technology evolution, network management and QoS. We also highlight the deployment issues at the transport level as a result of this model. We conclude this paper with an inference in section VIII.

II. WHY VALUE-BASED PRICING?

The upcoming mobile services can be classified into two broad categories as follows:

- User created person-to-person content services For instance, Short messaging service (SMS), Voice calls etc.
- Commercial content services. For instance, streaming video, games etc.

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By definition, the sustainable price of any service lies between a consumer's willingness to pay and the cost of production [4].

i.e., cost of production < price < willingness to pay

Currently, the pricing models for many of the mobile services are not completely independent of the transport charges incurred. In other words, besides the service charge, customers also need to pay for the transport, based on volume of data usage or transport level traffic [5], for instance, MMS over GPRS networks. This means that the total price of a service is the sum total of the service charge and the transport charges. Transport charges are highly unpredictable and at times expensive (for higher volume services), thus leaving the entire price of a service unpredictable and hence unpopular.

We consider two scenarios to understand the impact of transport charges on mobile services and operators' revenue.

A. Scenario 1: Service Cannibalisation

Table 1 illustrates two such instances of services that can be cannibalised by including the transport charges. Streaming video (average file size of 600 MB) and streaming audio or a song (average file size 4 MB) are considered. Assuming the price/KB as 1 cent [5], the total charge of each service well exceeds the perceived value of a customer. This could harm the popularity or demand of a service leading to its failure. The worst case happens when a higher degree of traffic overhead due to services provide little value to the customers. For instance, spam emails.

Charge/Service	Streaming Video (600MB)	Streaming Audio (4 MB)
Total Charges (€)	6006	41
Perceived Value (€)	6	1
Transport Charges (€)	6000	40

Table 1 Impact of transport charges on services

B. Scenario 2:Operators'Revenue Cannibalisation

The introduction of multimedia services along with greater competition has transformed voice into a commodity service. With convergence of voice and data, pricing of services on the basis of volume or data-size poses issues (marginal cost reduces to zero) [6], leading to competition among the incumbent operators, driving the prices closer to the cost. This maximises the consumer surplus or welfare at the cost of reducing the operators' surplus and sometimes even losses. Hence, the operators find lesser incentives and ability to invest in better technologies and services in the future, thus harming the interests of the consumers in the long run.

In both the above scenarios, a pricing model based on value of the service and price differentiation would help to maintain the profit margins essential for the operators to recover the costs and rollout successful services. Hence, the operators should aim for generating greater value-based services and not greater traffic. The model and its benefits are explained in following sections.

III. VALUE-BASED PRICING MODEL

By value-based pricing, we mean pricing a service based on the value perceived by the consumer instead of the amount of data traffic. However, evaluating the perceived value of a service is a challenge for the operators. We list here some of the factors useful in evaluating this value.

The mobile services offered could further be classified in to substitutes and new services. In case of a substitute service, the existing service charges can be taken as a benchmark or perceived value by the customer. For instance, a movie can be charged at 6€ and a song at 1€. Any attempts to have a higher price tag will bring down the demand as explained before. New services, with the absence of a benchmark, on the other hand, enable operators to charge higher according to the demand by the customers.

With convergence, the phenomenon of network externality [7] enhances the value of a service and is hence another suitable component of a value-based approach. Greater the number of customers using the service, greater is its value.

This approach would eventually help to maximise the value per byte of a service and not the bytes per se.
i.e., if **p** is the price of a service with value **v** and let **B** be number of bytes needed to complete this service, then,

$$p = max\ \{ v/B\}$$

where price **p** can be maximised by rolling out services that maximises the value and minimises the usage of bytes **B** or data size. SMS and MMS messaging services are two good examples of such services.

In order to achieve this, we propose the value-based model as illustrated in figure 1. The over all model is based on the approach of *vertical bundling of a service*, i.e., instead of pricing the services per Mbyte of data, the operator offers a single price to the consumer that represents the value of that service while the revenue thus obtained is shared among the operator and content provider based on a mutually agreed revenue-sharing model.

In figure 1, we define three planes and their interfaces. The three planes are:

- Content Provider Plane: This plane consists of a number of content providers offering different types of commercial content services.
- Mobile operator Plane: This plane consists of the mobile service operators represented here as OP1, OP2, OP3 etc.
- Customer Plane: This plane consists of the customers or subscribers in the mobile market represented here as C1, C2, C3 etc.

The two interfaces are:

- V_{int} or value interface: This is the interface between the operator and the customer where the real value is created by adopting value-based pricing.
- TC_{int} or transport-content interface: This is the interface between the service operator and the content provider. Revenue sharing between the operator and the content provider is done at this interface.

S1, S2, S3 represent the service set or bundle offered by each operator to their respective customers.
i.e.,

S1 = {s11 + s12 + s13 + ….s1n}
S2 = {s21 + s22 + s23 + ….s2n}
S3 = {s31 + s32 + s33 + ….s3n}

and so on.

These service sets may overlap with each other. This is also known as horizontal service bundling. An operator may also choose to give unbundled services.

According to the model, an operator, say OP1, will provide a service set S1 to its customers C1 using value-based pricing at V_{int} . In other words, this would mean that the services are vertically bundled with the transport or the mobile subscriber identity module (SIM) and horizontally bundled with other services in order to create service differentiation.

In short, this would mean that at V_{int}, the price would be given as,

$V_p = C_p + T_p$ where, V_p = Value-based_price
C_p = *Content_price*
T_p = *Transport_price,*

It is to be noted that T_p here doesn't mean a price calculated per Mbyte usage. It only means that the value-based price includes the transport charges and there is no separate charge on the data usage of any service.

Further, the horizontal service bundle can be priced based on Ramsey pricing model to achieve consumer and producer surplus. Ramsey pricing is especially suitable in this case where operators' cost recovery is one of the primary goals.

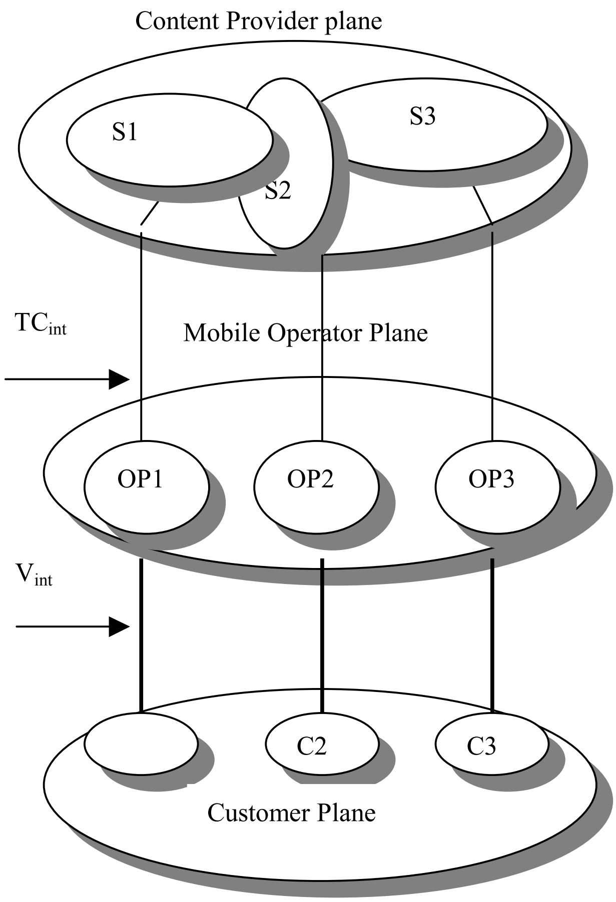

Figure 1 Value-based Model

In our model, let us take the first operator and its customers for instance.

The operator OP1 will provide a service set S1, where,
S1 = {s11 + s12 + s13 + ….s1n}

The price for all services together can be expressed as,

$P1 = (v/B)_1$
where v = total value of the service bundle
B = Total transport usage

For individual services in the set S1, this would mean,

$P11 = (v/B)_{11}$, $P12 = (v/B)_{12}$, …. $P1n = (v/B)_{1n}$

So,

P1 = { P11 + P12 + P13 + ….P1n},
$P1 = \{(v/B)_{11} + (v/B)_{12} + (v/B)_{13} + \ldots (v/B)_{1n}\}$

The overall price of the service bundle P1 can be maximised by including larger number of services with higher value v and lower transport usage B (for instance SMS and MMS). Services with inelastic demand have to be included in the mix. Having such services would enable operators to cross-subsidise other lower value services (having elastic demand) in the bundle like bit pipe access. This model would ultimately provide greater value for the customers and cost recovery for the operators.

Such a service bundling and pricing model would also enable service differentiation from competitors and reduce cost. The scheme promotes the idea of choosing value over transport usage as the primary goal.

However, this, of course, introduces new business models and hence new challenges in revenue sharing at the transport-content interface (TC_{int}). We focus on these challenges at the transport-content interface of the value chain, and propose solutions for the greater benefit of the players involved in the following section.

IV. REVENUE SHARING MODELS

Here, it is important to recall the service classifications explained in section II. User created content the operators provide services like SMS and MMS and hence the revenue generated from these services need not have to be shared with the content providers. Hence, one possible avenue for greater revenue generation for an operator is to provide more of such user created content services.

However, not all services, commercial content in particular, can be created by the operator and hence will have to share the revenue with the content providers.

A major factor for any successful business model is to generate profits for all the players involved. The business model based on the proposed pricing model introduces the same challenge. In this section, we focus on the transport-content interface (TC_{int}) that needs a definite commercial content services revenue sharing model to overcome this challenge.

The cost components of both the operator and the content provider need to be identified in order to identify the correct proportion of revenue to be shared between the two players. Three major components from the operator's perspective are:

- Billing and charging
- Network expenditure
- Customer management

From a content provider's perspective, the major component is the content development cost.

Based on the above components, a mutually agreeable percentage share of the revenue generated has to be negotiated at the TC_{int}. This percentage will be a variable depending on the value of each service.

i-mode's strategy [8] of taking a fixed commission of 9% can be a subset of this model. However, it has to be noted that unlike i-mode, our model doesn't charge for the transport usage. The success of i-mode could largely be attributed to the unique and innovative value-added services provided. However, with similar services being rolled out in the market today and greater competition, operators cannot expect to make revenue only from transport usage as in i-mode's case (85% of total revenue). Hence, emphasis should be more on value-added services.

Digital Rights Management (DRM) and superdistribution [9] could be used to implement our model for distribution of mobile services effectively.

V. ROLE OF COMPETITION

While our model is mutually beneficial to both the operators and content providers, it must also consider the welfare of customers. Competition plays a key role in this regard by acting as a balancer. The vertical bundling enables greater competition among the operators at the $V_{int,}$ keeping a check on the service prices and maintaining higher value and innovation in service offerings, thus providing a better deal for customers.

On the other hand, TC_{int} experiences competition among content providers and operators. This enables both operators and content providers to experiment with new services as well as arrive at better revenue sharing models.

Hence, competition at both the interfaces will provide a dynamic mobile market and industry with greater innovation and optimal prices leading to a win-win situation for all the players concerned.

VI. ROLE OF MARKET UNCERTAINTY

In recent years, success of mobile services and technologies has become increasingly uncertain. Such market uncertainties create opportunities for experimentation [10]. Value-based model provides such an opportunity for operators and content providers alike in experimenting with new service rollouts. New services can be introduced (free of charge) as part of the service bundle in order to gauge the customer demand and thereby evaluate the value. An appropriate value can be charged on a later stage if the service gets popular. Thus, TC_{int} enables greater sharing of risks among the operators and content providers. This arrangement in turn will create a dynamic mobile services market.

VII. IMPACT ON NETWORK TECHNOLOGY AND QoS

Currently, providing quality of services (QoS) [11] to customers has been a major concern among network operators. While operators are looking for "killer-apps" that can drive their revenue shares, this could also increase their operating expenditure, especially due to applications that generate huge traffic.

A drive for greater value per byte would enforce higher incentive for content developers and operators to optimise the technologies involved. This in turn would pave the way for better resource management of networks due to reduced load and thus better QoS for the consumers.

This would also lead to greater understanding and synchronisation between the operators' and network designers' goals and contribute towards better traffic forecasts crucial for future network planning.

However, there are some technological impediments involved in implementing a value-based pricing model. Charging and billing machinery is one among them. The existing machinery caters mainly to the time-based and volume-based charging schemes. It has to be tuned to take care of value-based pricing.

VIII. INFERENCE

The possibility to provide a wide spectrum of mobile multimedia services to subscribers' mobile phones introduces new challenges and opportunities. In this paper, we outline those challenges and propose solution based on a value-based pricing model. We revisit the significance of Ramsey pricing in this regard and show the usefulness of this model using service and price differentiation. We show how this approach works better than a volume-based model. i-mode case is compared with our model. Pricing of a service depends mainly on the demand, cost function and competition. Our model's emphasis on value would create greater demand, reduce operational cost and create service differentiation. Such a pricing scheme would satisfy customers ensuring reasonable price, higher value and loyalty.

We conclude with the statement that conveying the value of a service to a subscriber and charging them based on value would benefit the content providers and operators in the long run, and would also enable the rollout of higher value services for the benefit of customers. This would drive both innovations at the content layer as well as better optimisation of network usage at the transport layer, thus maximising the utility for all the players involved.

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