

Content-Based Pricing of Services in the (Mobile) Internet

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1 Abstract

As Internet connection markets gradually mature and signs can be seen of a change towards the commoditization of Internet connectivity—fixed or wireless—special interest is focused on content-based pricing of services both in the Internet and in mobile service networks.

After presenting the background, key concepts and the current situation of content-based pricing, this paper focuses on the basic principles such as the importance of content service differentiation, willingness to pay in price determination, price discrimination, bundling of content services, and revenue sharing between operators and content providers. In the end of this paper an exemplary technical architecture for the delivery and content-based billing of (multimedia) content is presented. The emphasis of this paper, however, is on *pricing*, not billing or charging for content services.

Keywords: content-based, pricing, billing, charging, Internet, mobile, services, heterogeneous networks, multicast caching

2 Introduction

New pricing and billing models and charging methods are needed for the emerging mobile and fixed Internet services. A big question for the future of these services is whether the mobile and wireless data networks can be seen just as a *new kind of wire*—the user becomes nomadic but the Internet stays the same—or as an entirely new environment, in which essentially new attributes exist for service value perception compared to the fixed Internet. Examples of these attributes can be found in mobile services taking advantage of time and location information of the user. This question—a new wire or a new playground altogether—bears great significance also for service pricing.

It is likely that the prices for raw data transmission for both fixed and mobile Internet eventually decrease. A fixed-rate policy is currently preferred [6] by many customers—for example in the home broadband market—but nevertheless, data transmission is becoming a commodity no matter what kind of pricing schemes are applied. With this assumption it seems logical that principles and techniques for content-based pricing should be developed and applied.

A key issue in the pricing of Internet services is customer acceptance. Today Internet users are accustomed to free services in the fixed Internet (that is, after the connection is paid for). On the other hand, the mobile industry has established an environment in which billing has been a central design factor from the beginning and mobile users look at paying for services as a natural thing to do.

For content-based pricing to be meaningful, also the technology and business-to-business arrangements for billing must be put in place. Technical questions must be answered concerning appropriate paying solutions (credit cards, pay-pals, pre-paid, e-bank micropayment solutions etc.), and also the technical solutions to integrate content production, aggregation and delivery. In this paper, however, emphasis is on the pricing principles. Only an exemplary technical solution for content-based billing and delivery in heterogeneous wireless network is given in the end of this paper.

3 Current Situation

If we look at the current situation of Internet, services with content-based pricing are clearly in the minority. Most of the Internet sites (and the services they contain) are free in the sense that no direct payments are being paid. Instead, the service providers' revenues are often based on advertising or other indirect sources of revenue. For example the popular Internet Movie Database (www.imdb.com) lives on advertisements as well as on

providing an added-value service for Amazon.com in selling DVD movies.

Online substitutes for brick-and-mortar retail stores of course charge for their content—such as CDs or books—but experiences from content-based pricing of immaterial Internet services are less frequent. Some examples from the fixed Internet can be found, however, such as e-banking services (solo3.nordea.fi / monthly fee), a wine review database (www.viinilehti.fi / yearly subscription) and several stock exchange data services with monthly fees.

On the mobile side the supply is more varied despite the fact that the most popular services are implemented with the technically and visually primitive SMS technology.

4 Pricing Principles for Content Services

As far as content services in the fixed and mobile Internet are concerned, it is usually very costly to produce the first copy of the content itself whereas only very small costs are often associated with the delivery of multiple copies to customers [2]. This forces the service providers to consider new pricing techniques compared to the traditional marginal-cost-times-n rules of thumb—because the marginal cost may be zero or near zero.

4.1 Commodity-like Content Markets Unviable in the Internet

The basic principles related to the topic of content service pricing are intuitively presented in *Pricing Information Goods* [2], an article by Hal R. Varian. First, the content service provision market must not be purely competitive, or else viable pricing possibilities do not exist. That is, if exactly the same information services are offered by various players and the marginal cost of delivery is zero, the fixed costs related to producing the information cannot be recovered: in a purely competitive market some producers will always drop the price even lower until no one can make profitable business—or until the one with the greatest tolerance for losses remains as the monopolistic service provider.

In this light the key is the differentiation of services. With adequate level of differentiation in place, content providers should have enough market power to engage in pricing the services according to customers' willingness to pay instead of marginal costs.

4.2 Service Differentiation: Fixed vs. Mobile

Taking into account the crucial role of differentiation in building profitable content services, a very interesting question arises: how much lead does the mobile environment have compared to the fixed Internet because of the fact that mobile services can be better differentiated using timeliness, personalization and location information as factors of differentiation?

For the reasons presented in the previous subchapter, a high level of service differentiation has a decisive importance for the economic success of information services. This leads to another open question: is the differentiability advantage of mobile networks so great that industry will put the effort to try and build a mobile service network (distinct from the open Internet) to enforce the creation of new chargeable services? Today the Internet has a huge lead over mobile services (SMS, WAP etc.) as far as the multitude and diversity of services is considered but the fundamental differentiability of the mobile might have the momentum to turn this direction. This paper leaves the question unanswered but it certainly warrants further research. But what goes without much dispute, is that the true quality of the product remains as the number one factor of differentiation.

4.3 Willingness to Pay

For content-based pricing, willingness to pay (WTP) is the key rule for price definition [2] due to the divergent marginal cost structure of information goods. A central observation is, however, that different users' WTP may vary a lot. In economic sciences several methods have been created for estimating WTP values. The results acquired by using these methods also vary substantially despite keeping other experiment parameters unchanged [7]. Thus, these results can be used only as a starting point for price definition. Fortunately, the finding for content business in the Internet or mobile environments is that price setting is technically more flexible than ever before in history. With no printed price tags, the content prices can be mass-customized for different user groups or even personally. The price tags being as immaterial as the goods itself, the content business in information networks puts price discrimination into a new light.

4.4 Price Discrimination

As WTP differs among content consumers it is generally profitable to charge different users different prices, which is the essence of price discrimination [3]. Three

degrees of price discrimination are commonly presented in literature:

First-degree price discrimination

Markets of one i.e. prices are set for each customer individually. This is more or less a theoretical option: if not anymore because of technical problems related to physical price tags, there are problems related to getting accurate data about single customers' real WTP.

Second-degree price discrimination

In a word: versioning. By producing different versions of information content products (perhaps following the goldilocks paradigm [4] of three versions) the offering can become better for both the content provider and the user. Users with different WTP will be better served and the content provider can increase its revenue.

Third-degree price discrimination

Different prices for different groups: student discounts are a clarifying example. This is probably the most classical form of price discrimination and also the most widely used and thoroughly studied. Once again, the goal is to maximize revenue by selling to customers with different WTP, each with the optimal price.

It appears, however, that the content business cuts both ways as far as possibilities for price discrimination are concerned: technically the prices can be very easily changed and even one-off tailored (bringing great opportunities for experimenting with price discrimination) but on the other hand, customers can easily search for the network of the cheapest price. That will decrease the applicability of especially third-degree price discrimination. It is easy to sell hard-cover text book in the U.S. with a high price, and also a black-and-white paperback version of the same book in India for \$5 but what can you do if both markets are to be served on a global website? Effective enough versioning may work, but customer group division is much harder unless the anonymity of users can be reduced by introducing for example customer loyalty programs.

4.5 Content Service Bundling

The nature of content services like online newspapers, sports result portals, magazines or stock exchange information services is often such that users are especially interested in just some specific pieces of information (like a certain article or a single stock price) instead of some information entity as a whole. However, studies show that people have aversions about paying separately for every tiny action. Instead, they prefer bundled services. Traditional magazines are one example of bundling: selling individual articles would be problematic for both readers and the content providers.

Another example are fixed rate Internet connections, which are perceived as more favorable by many customers compared to usage-based pricing [6]. The key finding is that the excessive *granularity of pricing* must be avoided.

Bundling can be implemented in several levels (for example within a certain content provider's own realm or within a content aggregation point or portal). In many cases portals or aggregation points are needed in order to simplify the technical issues related to billing. For example a home broadband account with fixed monthly fee may have extra services included and charged with a single bill: e.g. a telephone number search service, a stock quote service and a block (limited amount) of free SMS messages per month.

5 Operators, Content Providers and Pricing

To conclude, it seems practical to integrate diverse content services into a single portal or content aggregation point, at least as long as the situation with reliable online micropayments stays as it is today: multiple different standards and no global agreement.

By separating billing and content provision, two advantages can be achieved:

- Usability of services increases as the hassle with payments is minimized through consolidation of billing functions.
- The implementation of centralized billing solutions lowers the content providers' infrastructure costs.

In addition, also a more strategic advantage appears: with content aggregation policy in place it is easier to achieve a critical mass—volume and diversity of available content services—for content business demand-side economies of scale to emerge.

5.1 Revenue Sharing Models

On the grounds presented in the previous subchapter, the cooperation of content providers, portals, operators and mediators is needed. For this structure to work in an economic sense win-win deals must be designed for sharing the content sales revenue between content providers and operators doing the content distribution and billing. In the following table some figures are presented as examples of possible distribution of

revenues. (Adapted from a presentation [1] by Alan Huang, Cisco Systems, Inc.)

Table 1: Content revenue distribution between an operator and a content provider

User activity	Total Price	Allocation to operator	Allocation to content provider
Monthly network fee	\$40	100%	0%
Download of MP3 file	\$2	30%	70%
Check stock quotes / monthly	\$2	50%	50%
Purchase of hiking boots	\$112	9%	91%

In addition to economies of scale advantages in implementing content and billing aggregation in the fixed Internet, developing content partnerships with mobile operators is an attractive alternative due to the refined and well-established billing infrastructure within the mobile industry.

6 A Technical Solution for Content-Based Charging in Heterogeneous Networks

As wireless communications networks evolve, it is likely that not all geographical areas will be covered with wideband wireless networks capable of delivering rich multimedia. On the other hand, mobile data connectivity of a somewhat lower bandwidth will likely be available almost everywhere (e.g. GPRS, EDGE, or UMTS networks). For these *heterogeneous networks* that consist of WLAN hotspots, on one hand, and mobile data networks, on the other, an interesting method for efficient content delivery has been developed at HUT [5]. Based on multicast caches situated in WLAN access points and IPsec encryption of content packets, the system can also be used for content-based charging, not just efficient delivery.

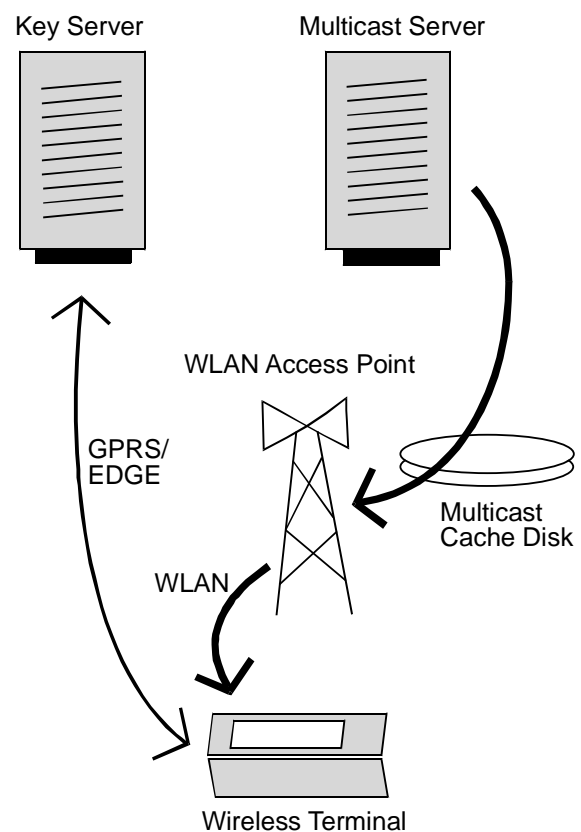
6.1 IPsec & Packet-oriented Multicast Caching

For efficient delivery of rich content in wireless networks, multicasting technology holds much promise.

If we take a hundred-page national newspaper as an example, it seems a waste of time, money and network resources to send it individually to all its thousands readers. Instead, by multicasting the information can be sent simultaneously to multiple users.

Some problems arise, however. Not all customers will want to receive and pay for all the data being multicast and not all wireless terminals (PDAs, laptops) are powered on and within hotspot coverage during the multicast transmission. Also, when moving from an access point to another packet loss may occur. These problems can be addressed by multicast caching. The multicast data is stored in access point cache disks [5], from which wireless terminals can download the data when terminals are switched on, or when hotspot coverage is reached. The data in these multicast caches is not stored as files but instead as IPv6 packets that can be individually fetched from the cache.

Picture 2: Overall architecture of multicast caching content delivery system



The beauty of this system in the light of content-based pricing and billing lies in the fact that data can be sent using IPv6 IPsec encryption, so that encryption is in place in all phases of delivery, including storage in the

mobile terminal. The data can then be decrypted (i.e. opened, read) in the user application, if required decryption keys are purchased from the content provider.

With this kind of architecture it is possible to take advantage of WLAN access points' large bandwidth in downloading the content itself as encrypted, cached packet streams. However, after the content is transferred to the storage of a wireless terminal, the transferring of only very small data amounts is needed in order to acquire decryption keys for specific parts of the data, for example the culture pages of Helsingin Sanomat. This could be easily and inexpensively done e.g. with a GPRS connection—from the summer cottage veranda on a Sunday afternoon.

The technical features of the described system enable very fine grain resolution in content pricing—due to packet-based content retrieval and encryption—but one must keep in mind the pricing constraints imposed by customers' aversion for excessive granularity in pricing as well as the benefits of bundling in selling information goods [3].

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