Simple Competitive Internet Pricing

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Abstract

The Internet is free of charge by nature but since it is being adopted as infrastructure for wide communications networks it turns into a business. The pricing is a feature that was not taken into account when engineering Internet networks. This is one of the major problems that new infrastructures have to solve in order to provide Internet services and make it profitable. This paper presents the "Simple Competitive Internet Pricing" and analyses its suitability for IP based infrastructures, mainly wireless networks. This study describes the new Internet based networks area and proposes the utilization of "Simple Competitive Internet Pricing" to overcome the pricing problem.

1. Introduction

Internet was design for the agglutination of different networks with the intention of providing a robust networking infrastructure. The main goal was the network heterogeneity and connectivity but not Quality Service or Security or Charging. Nevertheless, Internet has been widely adopted as networking infrastructure because of the simplicity and open standards. Moreover, the deployment of Internet opened new business cases for communications services. Internet disrupted the traditional business model. The old market on the communications area was vertically integrated and tightly coupled. Internet was intended for creating a new networking mean to exchange data in a robust manner. The popularity of this new technology opened new business trend and existing operators may consider that it screw it all up. Nevertheless, Internet what did is to change the order and integrate the pieces within the business model in a different way. Moreover, Internet was moving in fixed networks but not it is moving into the wireless segment, which adds further complexity to the business model. This paper describes roughly the new business model and the money flow into the Internet based networking infrastructures. Section 2, presents the changes on the legacy communications business model comparing with the Internet model. Section 3, describes the "Simple and Competitive Internet Pricing" (SCIP) approach presented by R. Mason. This section analyses the flat versus the usage based pricing model and compares advantages and drawbacks. Section 4, maps the SCIP approach to the wireless IP based networks and tries to draw the lists elements and integrate them according to the new business model, including the expected money flow.

2. Internet business model

Internet changed the existing telecommunications infrastructures by providing a common technology for communicating data across different networks independently of the underneath technologies. The legacy Telco infrastructures had a vertical and tight integration of the services and the bearers or networks, and the money flow was clear and comprehensive. The network providers offered specific services on top of their own infrastructure that was built uniquely for that. Internet provides a mean for ubiquitous data transfer. The data is not differentiated and the network carries multiple varieties of data. The business model is not integrated anymore and the money flow is disrupted. It is not clear who buys from whom and who sells to whom. The Internet is built based on open standards that allow a quick and easy growth of applications and services. Internet provides a set of interfaces that allow developers to create applications and services independently of the carrier. The operators or Internet Service Provider (ISP) have to build the infrastructure in order to provide Internet access to the users. Nevertheless, the marginal cost of packet delivery on Internet is zero, which means the competition on Internet is not sustainable. The operators or ISPs have to build new relationships with content and applications providers, in order to get the revenues from user consumption.

2.1. Model flow

Internet has disrupted the traditional business model. The new communications based on open standards and interfaces requires building a new model and establish a new money flow. The value or supply chain on Internet established between the manufacturer (builds the infrastructure, equipments), the provider (operator that offers the infrastructure and services) and the consumer has been altered. Internet enables the possibility of having third party providers that offer services on top of existing operators. Moreover, Internet has created a set of dependencies outside the supply chain that can be financially block the money flow. The Internet depends on common and open standards that may lead into indirect manipulation or market failure. This means that regulators or standardization bodies shape the industry rather than the consumers or services demand. These problems also apply to the new IP based wireless networks. The wireless networks have been in the past a closed environment and Internet is opening this infrastructure to outsiders and the "Internet" model. There is a lack of proof for the new IP wireless model and whether the consumer will accept it or not. The DoCoMo has proved to be successful but this is a trivial case where the lower part of the chain is a monopoly and the money flow is well defined (Figure 1).

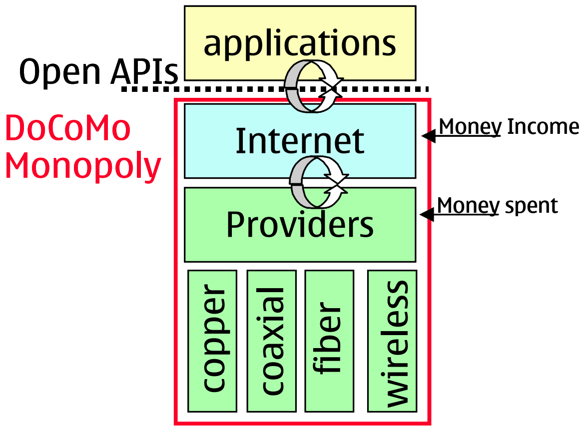

Figure 1: DoCoMo supply chain

The IP wireless model is still un-clear in the case where the supply chain is not controlled and the money flow is not clearly defined. The wireless networks have the downside that it is a closed infrastructure with limited access that is opening to Internet open model. It is foreseen that IP wireless networks have to implement an optimal pricing mechanism to overcome the coordination problem that would appear on the supply chain between access providers, content providers and consumers. Moreover, it has to be defined a clear money flow in order to provide a transparent flow of the revenues and location of the responsibility within the supply chain. The "Simple Competitive Internet Pricing" (SCIP) is considered as a pricing alternative that provides a simple and competitive mechanism for billing consumers based on competitive scheme. SCIP would be the suitable billing approach for binding the Internet with the provider layer and implement a money flow between both parts.

3. Simple Competitive Internet Pricing

The pricing on Internet was not part of the original design. Therefore, after the great success of the Internet the traffic has increased rapidly with the consequent congestion. The actual usage of the Internet without pricing is inefficient. In previous section we described that the actual marginal cost of packet delivery over Internet is zero, which cannot prolonged. Therefore, the actual Internet model needs to be changed and a clear money flow has to be defined. It means that a pricing model should be applied to the Internet in order to create a binding or dependency between the providers and Internet layer. The proposed pricing scheme has to balance between simplicity and robustness to competition. Moreover, the pricing model has to establish a money flow that originates positive feedback to the providers. Thus section examines the basic models and proposed the "Simple Competitive Internet Pricing" as one alternative.

3.1. Pricing Proposals

There are multiple proposals for incorporating the appropriate pricing scheme on Internet. Nevertheless, some of the most relevant are 'smart market' and 'Paris metro' pricing models.

The 'smart market' defines zero usage prices when network resources are not congested. When the network is congested, the packets are prioritized based on the amount the user bid for accessing the Internet. This auction-based approach provides good properties of efficiency. Nevertheless, it is too complex to implement since it requires that the routers on the backbone should link the biding information with quality of service parameters such as differentiated services (DiffServ, IntServ). Moreover, the providers that give access to the Internet should provide the auction mechanism and a secure packet marking.

The 'Paris metro' model consists of partitioning the Internet into logical networks with different usage charges. This model does not guarantee the service quality but networks charging higher prices are less congested. The users decide whether to select a less congested network and pay for it or just try the best effort Internet without any charging. Again, this requires a complex implementation where the networks are separated into logical subnets and the routers should apply different packet prioritization. Moreover, the providers should implement different packet marking depending on the subnet they are accessing based on the user preferences (congested versus charged).
Thus, the main problem for providers is whether they should implement Internet pricing at all. The customer is used to get a flat pricing model for the dial-up for fixed Internet access (ISP) or in near future also the new wireless dial-up from Wireless Internet Service providers (WISP) without any extra charge except the monthly fee. The users are charged by the providers for the leased-line depending on the lice capacity but the user face a marginal price cost of zero when traversing the Internet. Therefore, it is necessary to define clear set of arguments favoring pricing models on Internet applied by the providers and supported by the Internet infrastructure. Following section provides a pricing model and arguments for its implementation.

3.2. Simple Model

This 'Simple Model' includes a variable demand and overall positive network effects, which demonstrates that a flat rate pricing may occur in equilibrium.

Considering that the consumers are distributed uniformly along the unit interval, and they have a linear demand for a provider's product. The usage price per unit equals to p and the consumer demands 1-p units of the product. Considering two providers 0 and 1, a consumer located at $0 \leq x \leq 1$ receives a utility from accessing Internet via provider 0 of:

(1) $\quad U(x,0) = V + t(1-x) + ½ (1-p_o)^2 + nD_o - f_o$

V is a positive constant that represents a common utility received by all the consumers from the product of provider 0.

$t(1-x)$ represents the transport cost of consumer's utility ($t \geq 1$).

$½ (1-p_o)^2$ is the surplus gained by the consumer from the access via provider 0 when the usage price is p_o.

$nD_o \geq 0$ is a network effect parametes where D_o is the total demand of consumers who access via provider 0 ($n \in [0 , t]$ is a constant).

f_o is the fixed price charged by provider 0.

We assume that network effects depend only on the local provider demand and not on other providers since the products or different access technologies provided by each company are assumed to be different and incompatibles[1]. It is also assumed positive network effects dominate ($n \geq 0$). The network congestion is equivalent to reduce n but it still remains non-negative. Further research could include the dependencies of negative treatment of network effects on the model.

Simialrly, consumer located at $0 \leq x \leq 1$ receives a utility from accessing Internet via provider 1 of:

(2) $\quad U(x,1) = V + tx + ½ (1-p_1)^2 + nD_1 - f_1$

The terms have the same meaning and the provider 1 have different price charges (p_1, f_1).

In the analysis of this simple model, both providers have similar production costs. Fixed cost $k \geq 0$ per costumer, constant cost $c \in [0 , \hat{c})$ per unit of demand, and fixed cost m due to pricing scheme. The parameter m represents the cost of implementing the pricing model in case it is usage or block based since it requires additional equipment for deploying the charging system, but m is not used if pricing is flat rate model.

When applying the proposed 'simple model' the providers choose the type of pricing scheme to use (in this analysis they are limited to flat rate, usage of block tariff) and the level of the prices. The consumers choose the provider to access the Internet (considering V sufficient high that the consumer uses a single provider but not both) and the usage or quantity. The analysis of these conditions utilizes symmetric Nash equilibrium in pure strategies.

The results indicated that two-parts pricing can be in equilibrium only if the fixed of cost of charging is not too large (m > ^m). In the other side the flat rate solution can be in equilibrium only if the fixed cost of charging is sufficiently large (m < ^m). The flat rate equilibrium does not exist when m=0. This demonstrates that the two-part tariff is the best response from provider 1 when provider 0 applies flat rate charging in order to avoid flat rate equilibrium.

There may be other possible equilibrium depending on the values of m and n. When equilibrium exists, the flat rate provides the unique balance for high values of m (m >^m). However, the two-part tariff provides the unique equilibrium for low values of m. For intermediate values if m it can appear multiple equilibrium points for values of n sufficiently low but it cannot be equilibrium for larger values of n.

It is proven [1] that when both provides choose a two-part tariff can be equilibrium if and only if $n \leq n^*$ and m≤^m. Moreover, when both providers choose flat rate can be equilibrium when $n \leq \tilde{n}$ and only if m> ~m. In this model the congestion is interpreted, as a decrease of n. Therefore, if both providers choose flat price it may be equilibrium subject to positive network effects but with congestion. The value of m can be very small to ensure the existence of equilibrium with flat rate.

Once the conditions for equilibrium based on the pricing scheme are described, the main objective is to analyze the conditions for the maximum profit.

One the equilibrium is achieved the greater profit depends on the intensity of competition for the marginal consumer and the size of the fixed cost.

In two-part tariff equilibrium; $\pi_{2part} = ½ (t-n) - n/2(n/2 - c) - m$.

In the flat rate equilibrium; $\pi_{flat} = ½ (t-n)$.

Assuming m=0 then only the competitive effect remains and if n=0 the profits are $t/2$ in both models.

[1] This assumption may be argued because ISP would provide similar dial-up access to Internet. It would be incompatible when considering different access technologies. Nevertheless, the author [1] claims that it has no effect on the final results.

When $n > 0$ but $n < 2c$ (c= constant cost per access), the provider obtains double benefits in the two-part tariff equilibrium relative to the fat rate. The loss is smaller on variable demand because the usage price is positive and the surplus from the marginal customer is small. Nevertheless, when n grows the usage price decreases (unitl n=2c) and the price in the two equilibriums are equal. If n keeps growing (n>2c) the benefits of both providers with two-part equilibrium are reversed. The loss on the variable demand is greater and they have to compete for the greater surplus of the marginal consumer.

Another outcome [1] is that surplus is greater with the two-part tariff equilibrium prices that the flat rate equilibrium prices if $(n\text{-}2c)^2 > 16$ m. The surplus in two-part tariff will be lower that in the flat rate equilibrium if $(n\text{-}2c)^2 < 16$m.

The main outcome of the simple pricing approach is that there is no optimum pricing scheme that can be based on well-known Internet behavior. It is required to define a pricing scheme that is robust to competition. In this section it has been analyzed that the usage prices can lead into situations where only flat rate pricing achieves equilibrium (even with very small fixed cost of implementation). Moreover, it has to be considered the network effects since the congestion is interpreted as reduction of positive effects on the overall formula. The pricing schemes considered are quite limited and the addition of different pricing strategies (i.e. block pricing) would have effects on the results.

4. Wireless Internet model

The wireless networks provide a new model where there is no proof for right billing scheme. Within wireless networks there are different models depending on bearer technology. The UMTS networks provide a closed environment containing a standardized infrastructure and well-engineered set of services (audio, video, etc) that extend the existing wireless networks. Nevertheless, Wireless LAN networks provide an open medium for accessing Internet without infrastructure or having an environment protected by standards.
In both wireless alternatives based on the 'simple pricing' analyses it would be required to analyze further alternatives to usage and two-parts pricing schemes. Moreover, it would be required to define a clear money flow (Figure 2) within the supply chain in order to introduce new conditions for the equilibrium since the V may be not high enough meaning that the customer may access Internet using multiple providers. This would modify the results since V may be quite low in some cases.
In the fixed Internet access there was a single access technology but in the wireless environment it should be analyzed the ecosystems surrounding the different technologies access. There are different access technologies that included multiple dependences (standard methodology for Internet access; UMTS versus ISP type of dial up procedure within WALN). Furthermore, the cost per usage (i.e. c may include spectrum bid, infrastructure cost in UMTS versus only infrastructure cost in WLAN) is different on each technology access. This may lead into different equilibrium points for the same pricing scheme but using different technology.
Finally, the network consgestion is considered in the 'simple pricing' model as decrement on the positive network values. This parameter would have also different values on the wireless case, depending on the technology access. In UMTS networks the user quality and bandwidth is guarantee at some extend so the congestion is controlled and the impact may be insignificant when calculating the equilibrium point. However, when using WLAN access the network congestion may be quite significant when the usage grows, so the effect should be considered when containing the equilibrium point.

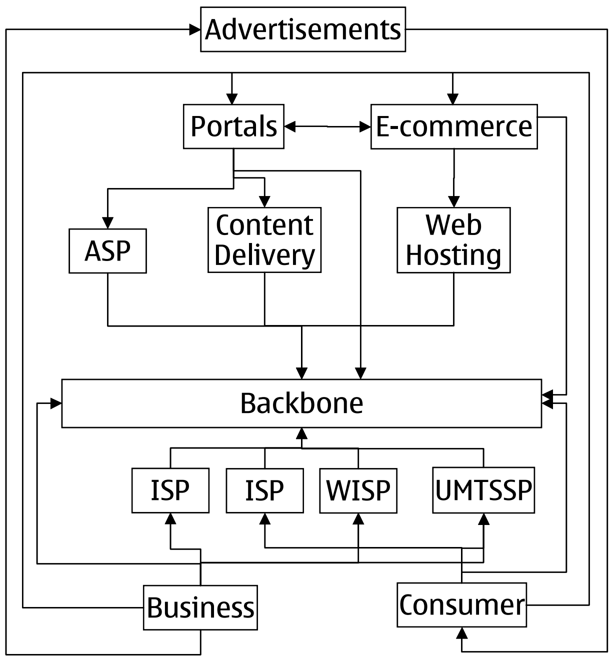

Figure 2. Supply chain with wireless models

5. Conclusions

In this paper the pricing problem in Internet based networks is presented. The nature of Internet is changing from its original academic intention into a commercial market place. Currently, Internet is free and it rarely depend on volume but normally the maximum bandwidth available is non linear. Due to the big success of Internet, the industry has selected deployed new IP based networks (wired and wireless) in order to provide access to Internet. This is creating new business model around Internet where there is no clear picture about the pricing scheme, differentiation and charging responsibilities around Internet. The providers are implementing usage, two-part or block based pricing schemes. In this paper the 'simple pricing' model has been analyzed for usage and two-part based model applied to Internet access providers. The conclusion of that analysis proves that the usage based pricing may lead into situation where fixed price provides an equilibrium situation. Nevertheless, the overall result indices that on the new wireless environment there are multiple and diverse players (providers with different technology access and basic cost, content providers, leased wireless access, etc) entering in the game. The conclusion is that the supply chain has to be re-drawn and the 'simple price' model needs to be revisited. It has to be include a set of new conditions and parameters that were assumed constant but on the wireless ecosystem are variable

References

[1] Mason, R.: Simple Competitive Internet Pricing, Congress of European Economic Association in Santigao, December 1999.