Service Bundling and the Role of Access Charge in the Broadband Internet Service Market

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Abstract: Using the classical Hotelling model, this paper analyzes the incentive for a CATV service provider to bundle broadband internet services when entering the broadband internet services market. In addition, the effect of such service bundling by an entrant on the market incumbent with ownership over existing bottleneck facilities is analyzed. Furthermore, an access charge that maximizes social welfare is explored and determined. Two cases are considered: in the first case, the market is fully covered; and in the second case, the market is not fully covered. With full market coverage, an entrant has an incentive for service bundling if there is sufficient service differentiation. The entrant's bundling strategy reduces the incumbent's profit. In this case, the total social welfare is independent of the level of the access charge and only has an effect of redistributing the net surplus between consumers and the incumbent. With partial market coverage, the entrant has an incentive for service bundling at a low access charge. The incumbent's profit increases if the access charge is higher than the cost of access provisioning. In this case, the total social welfare is dependent on the level of access charge and the welfare maximizing access charge is less than the unit cost of providing access.
Key words: cable TV; broadband internet service; bundling; access charge; convergence.

With the rapid growth of information and telecommunications technologies, the process of convergence between media and telecommunications service industries is accelerating. Many predictions in the 1990s on "telephone company entry into cable television" (JOHNSON, 1993) and "cable TV entry into telephony" (KIM, 1996) have already been fulfilled. Such convergence between media and telecommunications services demonstrates that competitive forces from other industries can crowd into a once monopolistic market.

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The entrance of cable TV companies into the telecommunications services market is one such example. In the Republic of Korea, System Operators (SOs), who had been providing only cable TV service to their local areas, have recently begun to provide bundled high-speed internet access services, utilizing their cable TV network infrastructure. However, in order to provide local areas with broadband internet services [1], SOs need access to various facilities belonging to incumbent telecommunications firms, including backbone networks, ducts, poles, conduits, and right of way. In response to the SO's swift penetration into the internet service market (*Electronic Times*, 2003), incumbent internet service providers (major telcos) have been trying to increase usage fees for bottleneck facilities [2]. In return, SO's have been accusing the incumbent providers of antitrust behavior. Under such circumstances, a governmental policy on access and access charges for bottleneck facilities is of focal interest.

One major issue that has not been clearly taken up is the impact of service bundling on the competitive behavior of the firms involved. As in the above example, an entrant's bundling strategy of leveraging its monopoly power in another market is likely to conflict with an incumbent's defending strategy of restricting access to components that are essential to competitors. According to the leverage theory, a monopolist in a particular market can dominate a second market by leveraging its monopoly power, thereby weakening fair competition in the second market. However, this leverage theory has been criticized by many, including POSNER (1976), BORK (1978), and SCHMALENSEE (1982). It has been argued that although a monopoly firm in a particular market can extend its monopoly power by bundling in another perfectly competitive market, this firm cannot increase its own profit by doing so. In this case, bundling has been regarded as a tool for price discrimination instead of as an anti-competitive behavior.

In contrast to this criticism, there are several recent studies claiming that bundling may exclude competition and affect firms' profit and welfare levels. WHINSTON (1990) and CARLTON & WALDMAN (2002) point out that if a monopolistic firm in one market is also an incumbent in another market with

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1 In particular, most rights of way and facilities such as ducts, poles, and conduits belong to a leading Korean telecommunications service firm, which also provides internet access service using xDSL technology.

2 Incumbent providers also accuse SOs of breach of contract. In particular, they argue that SOs should not provide high-speed internet access service using their essential facilities, since the original contract specifies that only a cable TV service will be provided via these essential facilities.

an oligopoly structure, tying can exclude the entry of potential competitors, by extending the firm's monopoly power. CARBAJO *et al.* (1990) and DENICOLO (2000) suggest that bundling can be utilized as a strategic device for product differentiation and market segmentation, resulting in a relaxation of price competition. Moreover, such a strategic bundling can contribute to enhanced profitability [3].

In our opinion, however, even if SO's are monopolistic in their local cable TV market, they are in a relatively weak position in the broadband internet market in that they must utilize an incumbent's essential facilities for broadband internet service provisioning. This situation is a typical example of a one-way access model. ARMSTRONG (1998) defines one-way access as "a setting where a firm monopolizes an input or group of inputs which is needed by all firms". In such a case, "there is the obvious danger that a network operator controlling key inputs will seek to exclude competitors by setting a high access price" (ARMSTRONG *et al*., 1996). Thus, regulation with regard to access charges is required to ensure socially desirable results (ARMSTRONG, 1998; LAFFONT & TIROLE, 2000).

To address these market conditions, this paper develops a simple duopoly model, in which an entrant competes with an incumbent by offering a bundled service, while utilizing a one-way access that the incumbent possesses. Our model setting is similar to that of WHINSTON (1990), with two key differences. Firstly, while a monopolistic firm in a market is an incumbent in the other market in Whinston's model, our model assumes a setting where a monopolistic firm in one market is an entrant in a new market. Secondly, the aforementioned one-way access setting is incorporated.

Most analyses utilizing the Hotelling location competition model have assumed full market coverage (WHINSTON, 1990; ARMSTRONG, 1998; FOROS *et al*.. 2001). In other words, these analyses implicitly assumed that consumers' valuation for services offered by the market were sufficiently high enough that all consumers subscribe to one service or the other. Under this assumption, profits and market shares of two firms are dependent upon the price differential. Thus, an interaction between two firms is explicitly incorporated in the model. In contrast, when the market is not fully covered, each firm behaves monopolistically within its respective local market. In this case, an interaction between two firms via price diffential is not explicitly

[3] Refer to CHOI (2004) for a summary of research issues and results on leverage of tying.

present. On the other hand, since an entrant must have an access to an incumbent's essential facilities, an explicit interaction between two firms via a one-way access charge is present in both cases.

Our model can be applied to a number of other telecommunications and media convergence contexts. For example, CATV SO's are also entering the voice telephony market with the upcoming VOIP service as part of their "triple service" plan along with the aforementioned broadband internet service. Following a similar logic to the broadband internet service market case, entrant SO's need to pay an access charge to incumbent telcos; the determination of the level of this access charge and its impact is a focal policy issue.

As another example, a Korean mobile carrier has just launched a service enabling subscribers to the mobile service to initiate or receive voice calls at the wireline telephony rate when these calls are initiated or received in the vicinity of their wireline telephone terminal. In this case, the mobile carrier is bundling its wireless telephony service with an additional cheapter mobile – wireline telephony service, in which case the mobile carrier needs to pay the access charge to the wireline service carrier. Consequently, the wireline carrier is in direct competition with the mobile carrier in its market due to the mandated interconnection duty imposed on the wireline carrier. Since the launch of this service in 2006, the determination of the level of access charge for both inbound and outbound calls for this mobile carrier, and eventually, the level of access charge for all telecommunications services, has been an active policy issue in the Korean telecommunications market (MUNHWAILBO, 2006).

In this paper, along with a model for bundling incentives, the following issues are addresed. Firstly, we explore whether there is an incentive to enter a broadband internet access market by bundling, and, if so, under what conditions these incentives exist. In addition, we explore how a cable TV provider's penetration into the market by bundling affects the incumbent. We subsequently examine how social welfare is affected by the level of the access charge for bottleneck facilities and determine an optimal level of access charge for maximizing social welfare.

■ The model

Suppose there are two independent markets, market 1(M1) and market 2(M2), where market 1 is a cable TV service market, and market 2 is a broadband internet service market. Let firm 1 be a monopolistic cable TV service provider in market 1 and firm 2 be an incumbent internet service provider in market 2. Firm 1 considers entering market 2.

For convenience, the size of the potential consumer pool is normalized to 1. Suppose that half of the potential consumer pool place high reservation value (v_H) on the cable TV service, and the other half place a low reservation value (v_L) on the cable TV service, where $v_L < v_H$. Firm 1 faces a constant marginal cost, c_{M1} where $c_{M1} < v_L$. Clearly, firm 1's profit is $(v_H - c_{M1})/2$ at price v_H and $(v_L - c_{M1})$ at price v_L. For simplicity, we assume that $(v_H - c_{M1})/2 \geq (v_L - c_{M1})$, in which case the best pricing strategy of firm 1 in market 1 is to set the cable TV service price at v_H.

In market 2, firm 2 is an incumbent broadband internet service provider, and firm 1 is a potential entrant. These two firms compete a la Hotelling in market 2. We denote the location of a consumer on a unit interval by x, $x \in [0,1]$, in which consumers are uniformly distributed. Suppose firm 1 is located at $x_1 = 0$ and firm 2 at $x_2 = 1$. Broadband internet service offerings of the two firms are assumed to provide the same value of v_{M2}. However, a consumer x is charged a transportation cost of $t|x - x_i|$ when subscribing to the service offered by the firm with location x_i, $i = 1,2$. This transportation cost represents disutility from the discrepancy between a firm's service and the most preferred service by a consumer.

Following CARTER & WRIGHT (1999), we assume that firm 2 has an incumbent advantage due to first-mover advantages and brand loyalty by adding a term $x_i t\beta$ ($i = 1,2$, $0 \leq \beta \leq 1$) to the consumers' utility function, as in [1]. As a result of this term, a consumer located at x is shifted towards the location of firm 2 by β. When $\beta = 0$, market 2 is characterized as symmetric competition, whereas when $\beta = 1$, consumers located at x_1 may prefer firm 2's service, even although the prices of the two services are the same.

Let's assume that firm i charges customers with price p_i. Then the utility of a consumer located at x who would subscribe to firm i's internet service is represented as:

$$U_i = v_{M2} - t|x - x_i| + x_i t\beta - p_i \quad i = 1,2,\ x_1 = 0,\ x_2 = 1 \qquad [1]$$

Firm 2 possesses bottleneck facilities to which firm 1 must have an access for service provision. Let c denote firm 2's cost of managing and repairing its bottleneck network facilities, and let a be the access charge imposed upon firm 1 per unit demand, which is imposed by regulation. In addition, there is a general cost such as general management, sales and administration, database management, and advertising for the two firms, which is denoted by c_{M2}. Thus, the total unit cost of operating in market 2 for firm 2 is $c_{M2}+c$ and that for firm 1 is $c_{M2}+a$. In this environment, firm 1's bundled service provides consumers with two options: consumers may purchase the cable TV service only, or they may purchase the bundled service [4]. On the other hand, if firm 1 chooses not to offer a bundled service, firm 1 will offer the broadband internet service in market 2 independent of market 1 [5]. Table 1 summarizes model variables and parameters present in this paper.

Due to significant differences in the results of the analysis, the business environment is categorized into two cases according to whether the market is fully covered or not. Full market coverage refers to the case in which the sum of consumers with positive utility, i.e., $U(x_i)\geq 0,\ i=$ 1,2, is higher than 1. On the other hand, the partial market coverage case corresponds to the situation where the sum of consumers with positive utility is less than 1. This definition of full and partial market coverage cases leads to restrictions on model parameters which we refer to as "market coverage condition".

In addition, we place additional assumptions of "non-negative market share conditions" for players 1 and 2 in order to further specify the range of the model parameters. These technical assumptions are fully developed in the annex [6] for both the full and the partial market coverage cases, which are assumed to hold for respective scenario.

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[4] Note that consumers cannot subscribe to the broadband internet access service without the cable TV service from firm 1. Therefore, our model can be regarded as a partial mixed bundling model. Accordingly, if consumers have already subscribed to firm 1's cable TV and need an internet access service, they can either purchase firm 1's bundled service or subscribe to firm 1's cable TV service and firm 2's broadband internet access service.

[5] Here, we are considering the situation whereby a cable TV service provider enters the broadband internet service market and provides its existing cable TV subscribers with the choice of bundled service. Consequently, the case in which consumers can subscribe only to firm 1's broadband internet service is excluded. This modeling assumption emphasizes the cable TV service provider's strategy of leveraging the monopoly power of its existing cable TV market.

[6] The annex is available on C&S website: www.comstrat.org

Table 1 - Model variables and parameters

v_H	High reservation price of consumers in market 1
v_L	Low reservation price of consumers in market 1
v_{M2}	Reservation price of consumers in market 2
x	Location of a consumer or a firm in market 2
t	Disutilify associated with a unit distance between a consumer and his/her ideal service in market 2
β	Extent of consumer loyalty towards firm 2 in market 2
c_{M1}	Firm 1's constant marginal cost in market 1
c	firm 2's maintenance cost of bottleneck network facilities
a	access charge imposed upon firm 1 per unit demand
c_{M2}	general managenet cost in market 2 for both firms
$\alpha_i, \quad i=1,2$	Market share of firm i
p_1^{WB}	Firm 1's price of bundled service in market 2
p_2^{WB}	Firm 2's price in market 2
$U_1^H \ (U_1^L)$	Net utility of subscribers of the bundled service with reservation price of $v_H \ (v_L)$
$\Pi_i^{WB}*, \quad i=1,2$	Firm i's optimal profit when firm 1 bundles
$\Pi_i^{WOB}*, \quad i=1,2$	Firm i's optimal profit when firm 1 does not bundle
$CS_i^{WB}, \quad i=1,2$	Consumer surplus for firm i when firm 1 bundles
$CS_i^{WOB}, \quad i=1,2$	Consumer surplus for firm i when firm 1 does not bundle

■ Full market coverage case

This section analyzes firm 1's incentive for service bundling in market 2, its effect on firm 1, and the welfare-maximizing access charge in a case where there is full market coverage. In doing so, the profit levels under various strategies of the entrant are compared, and conditions under which the entrant has the incentive for service bundling are derived. Derivations of equilibrium price, profit levels bundling incentives and social welfare results for both full and partial market coverage cases are supplied in annex [7].

[7] See: www.comstrat.org

Incentive for service bundling and the effect on the incumbent

Firm 1 will offer bundled service when $\Pi_1^{WB}* - \Pi_1^{WOB}* \geq 0$ which translates into the condition of $t(3-\beta) \geq \phi_1$ [8].

We remark that firm 1's incentive for bundling is independent of the level of access charge. Even if the level of access charge is above the marginal cost of providing it, c, firm 1 is not affected by an increase in the access charge. This is due to the fact that under full market coverage case, both firms' optimal pricing decision in the presence of an access charge compared to the case without an access charge is to increase the service price by the amount of the access charge. Moreover, the entrant's demand level is dependent only on the price differential between the incumbent and the entrant, not on the absolute level of respective service's price regardless of whether the entrant bundles or not. In this case, since both players' optimal pricing in the presence of an access charge is to increase the respective service price by the amount of the access charge, the price differential between two firms will be the same regardless of the level of access charge, thereby leaving the entrant's profit level unaffected by the level of the access charge in both bundling and no-bundling cases. For this reason, the entrant's incentive to bundle is independent of the level of the access charge under full market coverage condition. Of course, this result holds assuming that the level of access charge is set so that full market coverage condition is maintained. On the other hand, the incumbent's profit, regardless of whether the entrant bundles or not, is directly proportional to the level of the access charge.

Moreover, when consumers' disutility from being remote from their ideal service (as reflected by a higher t), the bundling incentive condition becomes easier to satisfy. A higher service differentiation in market 2 leads to a higher incentive for service bundling by firm 1. When a monopolistic firm in one market enters another market, a lower substitutability (higher differentiation) between the two firm's services makes the entrant's bundling a more effective way to leverage its monopoly power in another market.

We now turn our attention to the effect of the entrant's bundling strategy on the incumbent firm's profit, given a fixed level of access charge, a, by considering the profit differential between cases with and without bundling.

[8] Annex – available on C&S website – contains detailed derivation and variable specifications for this and following results. See: www.comstrat.org

We show that firm 1's bundling strategy always reduces firm 2's profit, i.e., $\Pi_2^{WB^*} - \Pi_2^{WOB^*} < 0$. These findings are summarized in proposition 1.

Proposition 1. Entrant's incentive for bundling and its impact on the incumbent's profit under full market coverage

- The entrant's profit and incentive for service bundling are independent of the level of access charge imposed by the incumbent;
- The more differentiated the broadband internet access service is, the more likely the entrant will prefer a bundling strategy;
- The entrant's bundling strategy always reduces the incumbent's profits.

Social welfare

Let consumer surplus for firm 1 and firm 2 be CS_1^{WOB} and CS_2^{WOB}, respectively, when firm 1 does not undertake bundling strategy. Then,

$$CS_1^{WOB} = \int_0^{x^*} (v_{M2} - tx - p_1)dx, \quad CS_2^{WOB} = \int_{x^*}^1 (v_{M2} - t(1-x) + t\beta - p_2)dx$$

CS_1^{WB} and CS_2^{WB}, the consumer surplus for firm 1 and firm 2 when firm 1 adopts a bundling strategy, are derived in the similar way. With some algebraic manipulation, we can easily show that regardless of firm 1's strategy, the total consumer surplus has the form of $-a$ + a constant term where the constant term is independent of the level of access charge.

The total social welfare can now be derived by combining the consumer surplus and the industry profit. We denote the total social welfare of the two cases by W^{WOB} and W^{WB} [9]. It is observable that the total social welfare is not dependent on the level of access charge, as long as the full market coverage condition is satisfied. However, the level of the access charge redistributes the total surplus between consumers and the incumbent. The decrease in the total consumer surplus from a higher access charge is directly translated into an increase in the incumbent's profit.

[9] Actual expressions are specified in the annex. See: www.comstrat.org

Proposition 2. Welfare results under full market coverage

- The total social welfare is independent of the level of the access charge when the full market coverage condition is satisfied;
- A change in the level of the access charge redistributes the surplus between the consumers and the incumbent.

■ Partial market coverage case

When market 2 is not fully covered, the market shares of firm 1 and firm 2 are determined by the number of consumers with the net utility $U_i \geq 0$. Thus, the market shares of firm 1 and 2 are $\alpha_1 = s_1 = x_1^*$ and $\alpha_2 = s_2 = 1 - x_2^*$ [10].

In this case, note that the two firms possess local monopoly power within their own markets. Consequently, a small change in one firm's price does not affect the other firm's demand.

Incentive for service bundling and the effect on the incumbent

Firm 1 has an incentive for service bundling if and only if $\Pi_1^{WB*}(a) - \Pi_1^{WOB*}(a) \geq 0$. We can easily show that service bundling is profitable for the entrant if $a \leq (v_{M2} - c_{M2}) - \phi_3$.

When the market is not fully covered, the access charge becomes an important factor determining the incentive for service bundling. Specifically, a higher access charge imposed by the incumbent discourages the bundling incentive of the entrant. An economic intuition behind this difference in the important factor for bundling incentive under full and partial market coverage cases is the following: when the market is partially covered, each firm behaves as a local monopolist. In this case, due to the the access charge that the entrant has to pay the incumbent, the profit of each firm is directly influenced by the level of access charge, unlike the full market coverage case. A low level of access charge directly translates into a low cost of providing the broadband internet service for the entrant. It follows that, since the cost of providing the bundled service is cheaper than the sum of cost of

[10] For definitions of s_1, s_2 , please consult the annex: www.comstrat.org

each service separately provided by respective firms, the entrant can induce consumers with low value for CATV service to subscribe to the bundled service, thereby increasing its profit.

In contrast to the case of full market coverage, the incumbent's profit increases as the access charge increases. The price reduction by the entrant, in accordance with its bundling strategy, does not affect demand for the incumbent's service, since market 2 is locally monopolized. On the other hand, the increased demand for the entrant's service, due to the price reduction, increases the incumbent's revenue from the access charge imposed by it. Consequently, if the access charge is set above the cost, the incumbent's profit increases because of the entrant's service bundling.

Proposition 3. Entrant's incentive for bundling and its impact on the incumbent's profit under partial market coverage

- The entrant has an incentive to bundle services when the access charge imposed by the incumbent is sufficiently low due to the fact that a low access charge directly translates into a low operating cost for the entrant under partial market coverage case;
- If the access charge is set above the cost of operating the essential facilities, the entrant's bundling strategy enhances the incumbent's profitability.

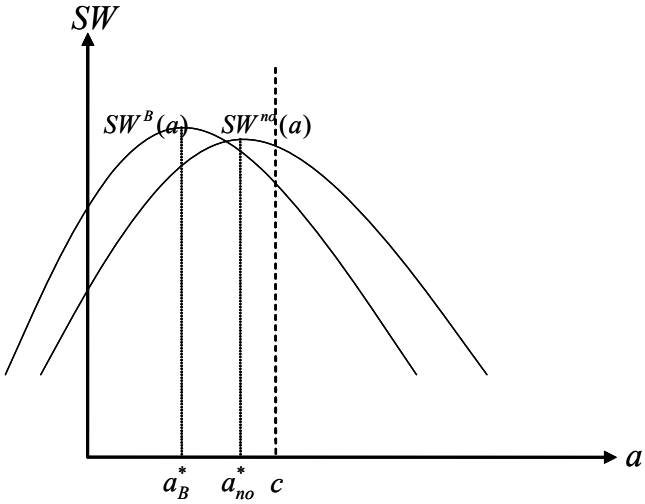
Social welfare

In contrast with the full market coverage case, the level of total social welfare depends on the level of the access charge when the market is not fully covere[11] This total social welfare is maximized at a_{WOB}^{*} without bundling and at a_{WB}^{*} with bundling.

From figure 1, notice that the total social welfare is maximized at the point where the level of access charge is below the cost c associated with the operation and management of the essential facilities.

[11] See the annex for all expressions: www.comstrat.org

Figure 1 – Social welfare as a function of level of access charge



Proposition 4. Welfare results under partial market coverage

- As the access charge increases, the total social welfare first increases and then decreases after reaching the maximum at a certain level of the access charge;
- The access charge corresponding to the maximum level of social welfare is at the level below the unit cost of providing the access.

In practice, one cannot force an incumbent to set the access charge at a level below the provisioning cost c for many reasons. One possible solution might be to set the access charge at the level of cost c. From figure 1, the social welfare function is maximized when the level of access charge is c in the range of $a \in [c, \infty)$. Such a cost-based pricing rule is widely accepted in the context of one-way interconnection and access provision. Another approach is to offer a subsidy in exchange for the incumbent's profitability loss. A similar observation and argument was made by ARMSTRONG (1998).

■ Summary and conclusion

The competition between cable TV service providers and telecommunications firms is the central force shaping the outlook of the convergence era. The broadband internet service market is one prime

example among many service segments in which these two players compete. This paper analyzes the incentive for a cable TV service provider to enter a broadband internet service market. Cases in which the broadband internet market is covered and is not covered are considered, with the focus on the existence of a bundling incentive and bundling strategy's impact on the incumbent broadband service provider. In addition, issues related to the access charges for the bottleneck facilities, such as the impact of the access charges on the total social welfare, as well as the level of the socially optimal access charge, have been explored.

If the market's total valuation for the broadband internet service is sufficiently high, the market will be fully covered. In this case, both the entrant and the incumbent reflect the amount of the access charge onto the service price in order to maximize their profits. As a result, the entrant's bundling incentive is determined independently of the level of access charge.

With more differentiation between services provided by the entrant and that of incumbent, the entrant cable TV service provider has a higher incentive to offer bundled service. This entrance by the cable TV provider lowers the profitability of the incumbent internet service provider, given a fixed level of access charge.

In addition, a change in the level of access charge does not influence the size of the total social welfare. An increase in the access charge decreases the total consumers' surplus; however, it also increases the profit of the incumbent service provider with ownership of the essential facilities. Since a rise in the access charge does not affect the entrant's profit and the total social surplus, these counter-intuitive results may become the grounds for advocates in favor of imposition of a high access charge. On the other hand, the level of the access charge redistributes the net surplus between the incumbent and the consumers. Therefore, the determination of an appropriate level of access charge depends on the judgment of policy makers.

When the market is not fully covered, because of the market's low valuation of the broadband internet service, the results are quite different. The entrant's profit decreases as the access charge increases, which directly affects the bundling incentive of the potential entrant. In this case, the entrant has a bundling incentive when the access charge is sufficiently low. A consequence of the entrant's bundling strategy is that the incumbent's profit increases if the access charge is set above the cost.

Under partial market coverage, the welfare maximizing level of the access charge is below the access provisioning cost. One might interpret the difference between the access provisioining cost and the welfare maximizing leve of access charge as a social subsidy. Since it is unrealistic to set the access charge below its cost, the access charge needs to be determined at the provisioning cost while the differential might be subsidized as a policy initiative. Furthermore, in contrast to the full market coverage case, these results may support the entrant's argument against an increase in the level of access charge.

As a more recent example, the VoIP service poses an issue that shares a similar structure to that depicted by competition in the broadband internet service market. A large telco typically generates nearly a third of revenue through the access charges, according to the California Public Utilities Commision. In this situation, whether the VoIP service is classified as a telephone service or as an information service dramatically changes future profitability of VoIP service providers, including cable TV companies and telcos. In early 2004, as a response to requests from activist groups related to the Free World Dialup VoIP service, the FCC in the USA made a temporary ruling that VoIP is essentially an information service and not a telephone service, and thereby will not bear a regulatory burden (FCC, 2004). In this case, any cable TV companies entering the telephony market via a bundled service of VoIP and cable TV will be exempt from the access charge imposition, thereby dramatically increasing their cost competitiveness. However, shortly after making this decision, the FCC initiated a more fundamental examination of the identity of VoIP in response to arguments for regulating VoIP by telcos. The initial findings of the FCC stated that internet telephony services that do not touch the PSTN are information services and will not be charged access fees, but will be subject to social obligations. Nevertheless, under neither scenario are VoIP providers completely free from fees. They are subject to reciprocal compensation fees in return for local interconnection (SHIN, 2006). As another force affecting the outlook of access chage regulation in VOIP market, the Intercarrier Compensation Forum consisting of AT&T corp., Level 3 Communications Inc., SBC Communications Inc. and a number of other telcos, submitted a proposal to the FCC to move towards a unified payment structure and the abolition of fees in 2011. However, Verizon Communications Inc. and BellSouth Corp. subsequently retreated from this movement, complicating the future course of this issue even futher. Nevertheless, VoIP market players seem to agree that the access charge issue is central to the future course of this market as the following remark by

Tony Clark, president of the North Dakota Public Service Commision, illustrates: "Really, the VoIP problem is an intercarrier compensation problem more than anything. If you can solve that problem, a lot of the other problems with VoIP go away." (LONG, 2004).

As another example, the IPTV market poses issues that can be addressed by the framework of this paper. In 1998 and 1999, AT&T corp. aggressively acquired cable TV companies such as TCI and Media One, in anticipation of using their networks to launch a bundled telephony and IPTV service, thereby competing with cable TV companies. One of the major predicted benefits of these actions was the avoidance of the huge access charges AT&T would have had to pay the local access network owner for the IPTV service. However, the unforeseen technological hurdle of converting the one-way network into the two-way communications network at the time forced AT&T to drop its attempt to pursue the IPTV service. The U.S. telcos that have launched IPTV services more recently, such as Verizon communications Inc. and SBC Communicatinos Inc., have bypassed the access charge issue since they own local loop facilities (Emerging Technology Report, 2006).

In the aforementioned examples of VoIP and IPTV markets, cable TV providers and telcos alternately took the roles of the entrant and the incumbent where the entrant tries to compete in the incumbent's market by bundling its own service. Moreover, the market force and regulatory guidance on the access charge is critical to each player's viability in both scenarios.

Given this importance of access charges to market performance, the distinction between full and partial market coverage cases can serve as a useful benchmark for policy makers. In cases of service bundling with access charges as described in this paper, the policy alternative is two-fold: 1) whether to allow the new service provider to bundle by entering a new market and 2) at what level the access charge should be imposed on the incumbent. With regard to the first alternative, trends towards liberalization in the telecommunications market, as well as recent trends towards digital convergence, have tended to favour the tolerance of bundling strategies for players entering a new market in most developed countries. In the USA, the FCC has been very supportive of cross entrance by cable TV and telcos into each other's market since the Communications Act of 1996. The Communication Act of 2003 in the U.K. initiated the launch of Ofcom, which now regulates both the broadcasting and telecommunications industries in anticipation of the launch of these convergence services (LIM, 2004). In

additon, Korean and Japanese policy initiatives have dramatically lowered barriers in broadcasting to telecommunications and telecommunications to broadcasting entrances. Specifically, the Japanese Ministry of Internal Affairs and Communications is considering launching an integrated department that is in charge of both broadcasting and telecommunications sectors together, partly for the purpose of supporting these convergence services (SHIN, 2004). As a result, convergence services such as VoIP and IPTV have been either launched or are being prepared in all of these countries.

In this environment, policy makers' influence normally foucuses more on the determination of the level of access charge. As discussed in the Introduction section, the determination of the level of access charge influences the resulting market outlook. However, as illustrated throughout this paper, the role and influence of the access charge differs dramatically between full and partial market coverage cases. When it is expected that potential demand for the service is very high so that full market coverage is anticipated, factors such as service differentiation only affect the bundling incentive of the entrant, without affecting the total level of social welfare. In this case, since the level of access charge only redistributes surplus between the incumbent and consumers, the policy maker needs to set the level of access charge depending on which party it deems to receive more share. On the other hand, when it is expected that there is not enough demand for the service to support both firms, the welfare maximizing level of access charge is below the cost of provisioining it. In this case, a clear guidance and a possible subsidy policy need to be initiated by the policy maker.

This paper points to at least two directions of further study. Firstly, this paper considers a single-period duopoly model. A multi-period competition model would be desirable in the following context. When the market is not fully covered, the access charge for the bottleneck facilities needs to be determined at the cost of provisioning it. If we consider further investment costs for the bottleneck facilities, such as the cost of a network upgrade, and the incorporation of new technologies by the incumbent, different results might arise. A multi-period analysis might be suitable for analyzing such context.

Secondly, the entrance of the cable TV player into the broadband internet service market is only one example in an environment where the trend toward convergence is accelerating, as exemplified at the beginning of this paper. As the network infrastructure becomes increasingly versatile and

intelligent, cross-entrance by media and telecommunications firms into one another's domain will surely occur. The convergence and competition between wired and wireless networks is another example of this convergence trend. In many possible scenarios of the convergence trend, the combination of the cross entrance model and the access charge model can address the issues of bundling incentives, service pricing, profitability, and access charge determination. A partial list of additional important factors for such analyses would include the installed base of each service, the extent of network externalities, the extent of service differentiation, and the first-mover advantage of the incumbent.

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