PLATFORMS FOR THE DEVELOPMENT OF DIGITAL TELEVISION BROADCASTING AND THE INTERNET IN JAPAN[1]

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I. Introduction

In Japan, digital television (DTV) for terrestrial broadcasts was introduced in December 2003. Due to historical, political, and other reasons, the introduction of DTV is considered merely as a replacement for analog with digital content; there has been little discussion regarding its impact on business practices and industry structure. Accordingly, in Japan, the benefits of DTV are said to be those of technical improvements such as spectrum saving, noise prevention, finer images (HDTV), and multi-channel capability.

The impact of the digitization of television, however, will reach far beyond those technical improvements for at least two reasons. First, it can increase viewer satisfaction by expanding their choices with regard to the timing of watching programs.[2] Further, it is now possible to increase the usefulness of the content to consumers by processing it with computer and storage technologies. DTV programs may be used and reused, with possible modifications, for educational, cultural, business, and other activities.[3] The potential benefits from this are so great that it is impossible to imagine them at present.[4]

Second, DTV has provided the possibility for television to compete and/or coordinate

[1] A revised version of this paper will be included as a chapter in a book entitled *Toward Digital Television: America, Europe and Japan*, edited by Martin Cave and Kiyoshi Nakamura, to be published by Edward Elgar, U.K., in 2006. Kindly do not quote from this paper before its publication.

[2] For instance, services such as "TiVo" in U.S. let viewers watch programs at a time and in an order chosen by them and greatly increase the benefits of TV to viewers (http://www.tivo.com).

[3] Needless to say, one should take into account copyright matters. See section III.

[4] Recall that when television or the Internet first became available to us, we did not foresee the enormous impact that the new media would bring.

with the Internet. In short, the Internet is a system for transmitting digital information on a global scale. DTV is a system for broadcasting digital information. It is evident that DTV and the Internet can and should work closely together for the benefit of society. However, because of certain historical reasons, DTV and the Internet at present time are still two mutually exclusive systems; competition and coordination between DTV and the Internet is yet to occur.

This paper deals with the impact of the introduction of DTV in Japan and in other countries, along with the possibilities of using the power of computer and storage technologies, and with DTV's competition and coordination with the Internet. It will focus on the need for, and the implication of, forming "platforms" for digital business, a way to establish "efficient division of labor" in the digital world, in relation to DTV. The paper will also attempt to identify political, legislative, and regulatory impediments to the smooth formation of such platforms and to suggest policy recommendations for overcoming them.

II. Digital Broadcasting and the Internet in Japan

Transition of terrestrial television broadcasting from the current analogue system to a new system, digital television (DTV), was started in Japan at the end of 2003, several years after DTV was started in UK and U.S. By 2011, terrestrial broadcasting for traditional analog television will be terminated according to a schedule set by the Japanese Ministry of Internal Affairs and Communication (MIC). It is uncertain, however, whether a majority of television viewers in Japan will or will not purchase DTV receivers, or whether broadcasters and cable-TV providers will or will not be able to deploy DTV networks to cover most areas in Japan, by that deadline. MIC has not made clear whether the use of spectrum blocks for analog television broadcasting would be terminated in the case that the purchase of receivers for, and the deployment of, DTV falls behind the scheduled time limit. MIC has made plans to subsidize

television broadcasters operating in rural areas with regard to deploying DTV services; however, no plan has been made to assist consumers, or regulate manufacturers, so as to promote the purchase of DTV receivers by consumers (even in the case in which consumers replace worn-out analog receivers).

Although DTV started earlier than 2003 with other media such as communications satellites (in 1996, called CS broadcasts), cable TV (in 1998), and broadcasting satellites (in 2000, called BS broadcasts), its introduction into terrestrial television broadcasting is considered to have a major impact, since its revenue in 2002 represented nearly 80% of all revenue for the broadcasting industry (including cable)[5]. The per capita (per consumer) annual revenue of the industry is approximately JPY30,000 (US$250), with the average length of time devoted by Japanese households to watching TV exceeding 3 hours per day[6]. Furthermore, terrestrial television is probably the most influential medium on the Japanese public in political, social, and cultural arenas.

The introduction of terrestrial DTV in Japan was made by replacing analog with digital broadcast content; in other words, DTV was not regarded as a new service under new rules or new regulations, but as the same service as analog broadcasting, in spite of the fact that spectrum blocks were assigned anew to the terrestrial broadcasters for DTV on top of ones having been assigned previously to analog broadcasting. Thus, at the time of the transition to DTV, few changes were made in rules or regulations applying to the terrestrial broadcasting industry by the Japanese government. In particular, no new entry into DTV was admitted; it is stated by the government that new entries in the future may be allowed once the DTV transmission is complete.

[5] See MIC [2004a].
[6] See NHK [2004]. Per-person time devoted to watching TV is approximately 1 hour per day (MIC [2004]).

There is one complication in re-assigning spectrum for the DTV transition in Japan. First of all, we note that, during the transition period, TV programs need to be broadcast in both analogue and digital channels, since it takes years for all viewers to replace their TV receivers from analogue to digital (simultaneous broadcasting). We also note that television as well as telephony is considered to be a universal service in Japan. Thus, virtually anybody living anywhere in Japan should be able to view at least 2 or 3 terrestrial television channels. In an attempt to satisfy this requirement, the Japanese broadcasters have constructed tens of thousand television antennas (mostly for program relaying) throughout the country with subsidization by MIC. Since Japan is a country full of mountains, virtually all of the 60 television channels, each with 6 MHz width, (that is, spectrum bands allocated to TV in the VHF or UHF radio frequencies), are used up to deliver analogue TV programs to every house without interference. Few extra channels are left available for the DTV transition. Simultaneous broadcasting seemed difficult in Japan.

Fortunately, however, by using recent technology, it was possible to reshuffle a small number of television channels in a region to move out temporarily a few analogue of them broadcasts elsewhere frequency-wise temporarily, and to accommodate DTV broadcasts to the vacated channels. By repeating this, all analogue channels could be converted to digital in each region. This is called “analogue-to-analogue transition” in Japan, which started in 2003. It is forecast that the DTV deployment will be completed throughout the country by the end of 2006. The cost for this is approximately 200 billion yens, which is to be paid from the spectrum user fees paid borne mainly by mobile subscribers. (The fast growth of mobile telephony in Japan after the second half of the 1990’s brought a huge windfall-type revenues to MIC.) MIC is carrying out this policy despite oppositions and critiques by experts and scholars on such unjustifiable use of the revenue. This is one of the examples in which MIC uses its regulatory power for promoting a project it is determined to conduct

such as the DTV transition.

The terrestrial television industry in Japan has been enjoying a monopolistic status for decades. In urban areas, the government issued virtually no new licenses for terrestrial broadcasting for the reason that there was no spectrum left available. In rural areas, spectrum was available; however, there were only a few licenses issued for decades presumably since the demand for television broadcasting was not sufficient to justify new entries. As a consequence of this policy, the average rate of profits in the Japanese terrestrial television industry has been quite high relative to that of other industries, although there is a difference between urban and rural broadcasters. Broadcasters located in Tokyo are called “key network stations,” supplying most of the broadcast content in Japan. (There are a few “quasi-key network stations” in Osaka, the second largest city in Japan.) The profits accumulated by the key network and the quasi-key network stations have been invested for the improvement of broadcasting equipment and also for producing high-quality public-appealing content. It is expected that broadcasters located in urban areas can bear the costs needed for the DTV transition, whereas those located in rural areas may not be able to bear all such costs.

Analog terrestrial broadcasters in Japan were not eager to introduce DTV in an attempt to maintain their monopolistic status. First, the decision for transition to DTV was made at the initiative of MIC, not by the industry itself. Second, the industry leaders preferred to minimize the impact of DTV transition; in particular, they wanted to maintain unchanged the environment and the structure of the terrestrial broadcasting industry. The government, MIC, made its policies for the DTV transition mostly along the lines requested by the industry.

As a consequence, the impact of DTV transition is explained to the Japanese public

mainly from a technological angle, not from an industry or regulatory one. Major benefits of DTV are said to be: (1) noise reduction with clearer images and sounds, (2) the realization of high-definition TV (HDTV, called “Hi-Vision” in Japan), (3) spectrum saving, and (4) the possibility of interactive TV. It is understood, however, that the benefits of DTV are not limited to technological ones; the greatest potential benefit of DTV should lie in the fact that, because DTV carries its content in a digital form, it is possible to process DTV content after they are broadcast by utilizing the power of computers and software. Consumers could enjoy content along with other valuable features. With analog television, the possibilities of content processing were limited; recording at a low quality was the only possibility. For the benefit of all consumers, it is desirable to prepare an environment for content processing as soon as possible and to the greatest extent; needless to say, copyright issues have to be taken into consideration. One of the objectives of this paper is to consider what policies should be taken in such a preparation.

The Internet today is, by far, the greatest means for transmitting digital information. It can move documents, pictures, music, and web pages smoothly in the form of digital information at a global scale. Although the capacity of the Internet to transmit digital video images may still be limited, it is expected that, in the near future, video images will be distributed on the Internet as freely as web pages are distributed today. For this reason, the relationship between DTV and the Internet is one of the most important issues in the transition to DTV.

In short, DTV and the Internet may be competitive in some aspects but complementary in others. Consumers will benefit more when DTV and the Internet are offered together rather than as two separate services. This expectation is expressed by the term “convergence of broadcasting and telecommunications.”

From the standpoint of consumers, it is desirable to be able to choose DTV or the Internet as a means of sending or acquiring information, regardless of whether it is a video program or another type of information. From the standpoint of content producers and providers, it is also beneficial to be able to choose DTV or the Internet or both as a means of delivery. In an ideal situation, a consumer or a producer/provider in information transmission could choose the means best fitting their needs. Note that, at present, we send an e-mail or obtain web pages on the Internet without paying attention as to whether the means of transmission is optical fiber, spectrum, or satellite.

Currently, broadcasting is the most economical means for transmitting information uniformly to a large number of receivers.[7] The Internet, on the other hand, is the most economical means for transmitting information from a particular point to another point on earth. Between these two, the efficiency of transmission means depends upon factors such as the number of origins, the number of destinations, or the required speed and the accuracy for each piece of information. Thus, DTV and the Internet may compete with each other in such cases, but, needless to say, competition promotes the growth of both.

It is possible, however, that DTV and the Internet cooperate, rather than compete, with each other. For example, consider a piece of information to be sent to a small number of people living in a particular area. The best means for transmitting such information could be a combination of the two. One possibility is that the information would first be transmitted via the Internet to a community broadcasting station located in the area in which the intended receivers live; a local broadcaster could then disseminate the information through wireless radio or TV. Relying only on DTV or

[7] Note, however, that the price of using spectrum for terrestrial broadcasting is currently set to be zero by the government; i.e., MIC issues a broadcasting license free of charge (Oniki [2005]). For this reason, broadcasting, as a means to transmit information uniformly to a large number of receivers, may appear distortedly more economical than the Internet.

the Internet, in such a case, may be quite costly. It is one of the purposes of this paper to consider policies that lead to a smooth combination of DTV and the Internet for efficient transmission of information.

III. Platforms for Efficient Utilization of DTV Content

A. Restrictions on content utilization with DTV in Japan

DTV in Japan is under rigid restrictions on utilizing content by viewers. First, all DTV programs are broadcast scrambled. In order for a viewer to have them descrambled, it is necessary to have an IC-card (called the B-CAS card) inserted in the proper slot in the receiver. B-CAS cards are issued by an organization, created and controlled by the terrestrial broadcasters in Japan, to manufacturers of receivers who have agreed to comply with the specifications required by the organization in producing receivers. In particular, a qualified receiver must satisfy a "copy-once requirement." In effect, a viewer can store or copy digital content only once; if the viewer creates a new copy, then the original is automatically deleted (hence, "copy once").

Such viewing restriction and copy protection was implemented first by satellite broadcasters (the BS broadcasters) when DTV on BS was begun in 2000. (This is why the name B-CAS card is used.)[8] Terrestrial broadcasters have agreed to use the same card that is used for DTV on BS. No legislation in broadcasting gave this right to broadcasters except that MIC did not oppose the introduction of the B-CAS card to BS and the terrestrial DTV. MIC would justify this action (or inaction) on the ground that it is endowed with the administrative power of overseeing and regulating the conduct of broadcasters. Thus, DTV content is protected in Japan by the copyright law through the system of B-CAS cards.[9]

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[8] Cable operators use the card called "C-CAS card," which functions in the same way as the B-CAS card.

[9] In the U.S., the Federal Communications Commission (FCC) has imposed a rule for protecting DTV content by attaching to content a "broadcast flag," which is a name given to technology, hardware or software, which makes it possible for content providers (broadcasters) to prevent DTV programs from being copied and distributed on, say,

The introduction of the B-CAS card to terrestrial DTV means that it is now possible for a broadcaster to introduce pay TV, i.e., to charge a subscription fee to watch a channel or a program. At present , however, no commercial broadcaster in Japan has introduced, or intends to introduce, pay TV, since it is believed that free commercial TV is the most profitable way of broadcasting.[10] [11] In the future, however, depending upon the speed of technological development, new services such as "TiVo" in U.S. (DVR service) may become so popular that it may be more profitable for a broadcaster to supply a portion of its content not as free commercial TV but as pay TV.[12]

From the standpoint of copyright protection, it is understandable that terrestrial DTV broadcasters introduced such a stringent restriction on viewing DTV programs. Copyright laws in Japan protect content producers including DTV broadcasters. In reality, however, it is likely that, without some effective means enforcing such protection, DTV content could be copied and distributed widely, as music content has been for years. Because of the introduction of the B-CAS card and the outright prohibition of copying from DTV programs, content producers and broadcasters will be heavily protected; at the same time, however, this makes it impossible for a third

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the Internet. The rule states that DTV receivers supplied on or after July 1, 2005, must comply with the broadcast flag requirement, although it has been vacated by an appeals court in May 2005 on the ground that the law does not give FCC the authority to control the handling of broadcast content once it is received by consumers. By the way, this rule, unlike the one in Japan, does not require that DTV content be scrambled, and it allows a broadcaster to adopt a technology from those certified by FCC for flagging its content. Further, whether to flag or not is up to the broadcaster. FCC explains that the introduction of a broadcast flag is to foster rapid transition from analog television to DTV by encouraging broadcasters to supply DTV content without fearing that they are copied and distributed illegally on, say, the Internet. See FCC [2002, 2003, 2004].

[10] The revenue received by the TV broadcasters for advertisement occupies the largest share of one-third in the total advertisement revenue in Japan (See, e.g., MIC [2004 a]).

[11] It is noted that the public television broadcaster in Japan (NHK), a nonprofit organization under a special law, charges a subscription fee from each owner of a TV receiver. The introduction of the B-CAS card has made it possible for NHK to collect this fee more effectively (the ratio of the number of viewers paying the fee to the total TV-receiver owners has been around 80% in recent years; there is no penalty for declining to pay), and also to collect it based not on the possession of a TV receiver but on the choice of watching NHK programs.

[12] DVR service is called "server-type TV" in Japan. It is a way to watch a TV program by first storing it in a storage device such as a hard-disk, and then actually watching it according to the time chosen by the viewer. In effect, it becomes possible for a viewer to skip advertisement portions (commercials) freely; hence, with this device, free commercial TV may no longer be a profit-making method of TV broadcasting.

party to process DTV content into a value-added product for consumers. In other words, if present-day protection of processing DTV content continues indefinitely into the future, we will lose an enormous benefit which may be obtained from processing such into values-added products and services for consumers.

The present state of DTV copyright protection in Japan may be illustrated by means of Figure 1, in which is shown a tradeoff of the degree of copyright protection with the possibility of developing applications software for processing DTV content. When protection becomes more stringent, then the possibility of developing applications software becomes less (and vice versa); this relationship is expressed in the diagram by a downward-sloping curve. The present state is expressed by the lower right-hand corner of the tradeoff, at which point the degree of copyright protection is maximized on the one hand, but the possibility of developing applications software is minimized on the other hand. A choice for society may be somewhere in between the extremes; it is shown as an optimal state in the diagram. Public policies for DTV transition should consider, in the long run, realizing such an optimal point.

B. Platforms for DTV applications

Applications software developed for DTV content, which can be installed on DTV receivers in the same way that computer software is installed on computers, can provide a great deal of satisfaction for consumers. The potential benefits of opening up the possibility of developing applications software for DTV content are so great for both consumers and producers that it is impossible to spell out even a portion of them. The benefit from DVR services is but a small one.[13] The present state of DTV, in which we have a lot of content but no applications software, may be compared to the state of computers in earlier days, in which there were little applications software

[13] One immediate example is application to school teaching. TV content such as news or news analysis may be used for producing teaching materials with the aid of applications software. Teachers may teach in class with a video which includes a fresh news his/her students watched just a few hours before.

but with a lot of analog content in the form of documents and statistics printable on paper.

One condition for the development of applications software for DTV content is to prepare an environment for transactions of content with a copyright. Copyright laws in Japan protect owners of a basic copyright and the rights derived from it such as duplicating, modifying, distributing (including web distribution) content, and so on. Business codes in the form of established rules of conduct for selling and buying (a portion of) a copyright attached to DTV content, however, are yet to be formulated in Japan. Database and network systems, which can support smooth transactions of a copyright, seem to be only at the stage of designing or testing, at best. Thus, a great amount of work is left in legal, business, and technological arenas before realizing smooth transactions of digital content with a copyright.

In the remaining portion of this subsection, we shall consider a “transaction system for DTV content.” Basically, it is an extension of the system for transacting goods and services, that is to say, the market mechanism. Goods and services are produced and sold freely by producers, and purchased freely by consumers, with a price attached to each object transacted. In extending the market mechanism to transactions of content, we need to pay attention to the differences between (ordinary) goods and services and “content.” As widely known, the most important difference is that content, unlike ordinary goods or services, can be copied with or without modification; technologically, there is no limit to making copies or adding modification. This is the reason we say that the potential benefits from utilizing content are great, but at the same time, it is the reason that copyright laws introduce a variety of rights derived from the basic copyright. Thus, the degree of complexities in transactions of content, including DTV content, is far greater than that in transactions of ordinary goods and services; we cannot avoid dealing with such complexities if we seek the benefits of

using content extensively. In short, the cost of transacting digital content is high. Since, however, for almost all cases, transactions of digital content are conducted on contracts written electronically, not on paper; the cost can be saved, accordingly.[14] We need a framework supported by computer applications for managing transactions of content.

The following is a brief outline of a system for transactions of digital content, to be built on copyright laws. First of all, we need to understand that the object of a transaction here is not content itself, but a right (or rights) attached to it. For example, the producer of content initially possesses all the rights attached to it, and may wish to sell the right to make 10 copies with prescribed restrictions on using each of the 10 copies. Since there can be many "rights" in relation to the content, and the value of each "right" may depend on the status of the other "rights," it is necessary that the status of the rights attached to the content be known to those interested in transacting one of them. This means that we need to create an information set which spells out the status of each right attached to the content and disclose this information to those interested in a transaction of such.

What is stated above may be realized first by creating, for content offered for transaction, a computer file containing the information which fully spells out the current status of the rights attached to the content; we call this file the "descriptor". Next, we need a database of the descriptors of content. This database should be disclosed to the public; each entry of the database should be administered so as to reflect transactions of all of the rights attached to content. For example, after the right to make 10 copies of content is sold to Mr. A with restrictions in using each copy, suppose that the original producer of the content intends to sell to Mr. B the right to make additional 5 copies of the same content. Mr. B should pay for this not only to

[14] For the basics of copyright economics, see chapter 11 of this book written by K. Domon and U. Joo and, more broadly, chapters 1-6 of Landes and Posner [2003].

the original producer of the content, but also to Mr. A, since the value of the 10 copies obtained by Mr. A is decreased by the creation of the 5 additional copies by Mr. B. These transactions between the producer, Mr. A, and Mr. B could be conducted privately without disclosing the information about the transactions. In order to realize smooth transactions of a large number of content by many participants, however, it is necessary to assemble all information about transactions into a database and disclose it to the public; otherwise, transactions cost would be prohibitively high. Observe that we do have such a system at present; the record of transactions of real estate is registered and disclosed; without such a system, real estate may not be transacted smoothly as it is today. Although the size of a database is greater in transactions of content than of real estates, the reason that a database for transactions need to be disclosed is the same with content as with real estate.

The following is an example of a simple descriptor of DTV news content which may be offered for sale by a DTV broadcaster daily for, say, school teaching. Suppose that the broadcaster offers copies of daily news as represented by the supply curve in Figure 2a, in which the supply price of a copy of the news decreases, but the total revenue from selling it increases, as the number of copies sold increases. Consider a system in which each potential buyer of the news registers the maximum price at which he/she is willing to pay for a copy; this will form a demand schedule as represented by the demand curve in Figure 2a. Suppose that, when the offer is closed (say, two hours after the news was broadcast), an equilibrium point like A in Figure 2a is found with the given supply and the demand curves. Then, N copies of the news will be sold to those having registered at a price greater than or equal to the level P; the broadcaster will obtain the revenue $R = P \bullet N$. This process may be repeated; the second round of registration may, say, start one-hour after, and end one-day after, the first round was closed; the supply schedule in the second round should be lower than that in the first round. And so on.

By means of such a system, broadcasters can expect additional revenues from selling news copies, and school teachers can enrich their teaching materials by using a copy of the news. It is conceivable that a vender specialized in the production of teaching materials from daily news participates to the formation of the demand schedule. Thus, a school teacher, on Monday morning after a weekend with a major M&A news, may find a good teaching material waiting for him/her in the desktop of his/her computer.

All of such transactions must be done with computers and software which comply with an extended version of the copy-once restriction under the B-CAS card in the same way as DTV receivers and digital content recorders comply at present.

Figure 2b gives an example of entries in the descriptor of a DTV news, which is put for sale by the broadcaster. The descriptor is stored in a database and is disclosed to the public. Entries in Item 1 of Figure 2b summarize the characteristics of the news. A supply schedule is given in Item 2, which is a list of pairs of price and quantity of content copies; it shows that the broadcaster is willing to sell news copies in quantity, say, greater than 2,000 and less than 5,000, at the price of 310 yens per copy. This schedule corresponds to the supply curve in Figure 2a. Next, the potential buyers of the news, whose preferences are aggregated into the demand curve in Figure 2a, may register individually of the number of copies to be bought and the maximum price payable for them.

Item 3 in Figure 2b exhibits the current state of the supply and the demand as matched on the database by a computer. The example reads that, currently, at least 2513 copies of the news will be sold at 310 yens per copy or lower; the number of copies sold may increase and the price may decrease, if additional demand is registered by potential buyers. Delivery of copies will be done after the offer is closed; the broadcaster

selling a copy of the news will send a "key" to each buyer for working with a copy of the news (200 keys to a vender buying 200 copies). This completes a round of the sale of the news.

Item 4 in Figure 2b outlines the conditions of using a copy of the news, as set out by the broadcaster. This example shows what may be called "cut-and-paste once" restriction, which is an extension of the "copy-once" restriction by one step. A user may cut any portion(s) of the news and paste them into another video only once; no more than one copy of any portion(s) of the copy of the news sold to the user can exist at any time. Further, each video to which portion(s) of the news are pasted should be subject to the copy-once restriction. Note that, although "cut and paste once" is a slight relaxation of "copy once," the potential benefits from it may be enormous, since, e.g., a large number of school teachers can enrich their teaching materials by means of utilizing portion(s) of broadcast news.

Designing the descriptor of content and a database of descriptors is a work which should be done from engineering, economic, and legal expertise. In particular, copyright laws should be revised so as to accommodate transactions of the copyrights of DTV (and other) content. Further, construction a system for transacting digital content should be done experimentally step by step. Naturally, a system for simple transactions of valuable (expensive) content should be constructed first; those for complicated transactions should come later. We look forward to seeing the development of a market mechanism for transactions of DTV and other digital content.[15]

There is one more point worth considering for developing applications software for

[15] We also note that the absence of a market mechanism for transactions of DTV content provides with a strong incentive for breaking copyright protection illegally, since there always exist a number, if small, of parties who wish to obtain a copy of content even at an extremely high price.

DTV content; it is the status of broadcasters. As pointed out previously, for historical reasons, broadcasters in Japan have maintained a unique status legally and economically. The economic status of broadcasters is that of a monopoly in the supply of broadcast content; this status has been protected by the government by not allowing new entries into the broadcasting industry for the purported reason of the shortage of radio spectrum. Regarding the legal status of the broadcasters, NHK is a public entity under the NHK law, while commercial broadcasters are private profit-seeking corporations. In fact, however, because of certain regulations, even commercial broadcasters have considerable obligations to the public. We may state that these obligations are, in effect, imposed on the broadcasters in exchange for the privilege of using the radio spectrum for broadcasting.

Because of the economic and legal status of the broadcasters, as stated above, there is little incentive to let DTV content be utilized with applications software for the benefit of consumers. In other words, the monopoly benefits enjoyed by the broadcasters, at present, seem to exceed the potential profits obtainable by supplying DTV content for applications software. There are two ways to alter this: one is to increase the potential profit of supplying DTV content for applications software, which was discussed in the first part of this subsection[16]. The other is to decrease the monopoly profit of the broadcasters. This will be discussed in the following section in relation to the competition and the coordination of DTV with the Internet.

There may still be yet another way to force broadcasters to let DTV content be utilized with applications software; i.e., by means of direct governmental regulations. It is conceivable for MIC to introduce, if step by step, “disclosure obligation” of DTV content on the broadcasters. The first choice of disclosure may be information

[16] It was reported in August 2005 that some of the Japanese broadcasters of terrestrial TV began supplying a small portion of their content on the Internet by means of IP-TV. The reason is that the share of the advertisement revenues on the Internet is rapidly growing at the expense of its share on TV. This could be a first step toward using broadcast content widely with values added by applications software.

supplied by the government itself such as an interview with the Prime Minister or a video record of a session of the Parliament. The second choice may be a news item, for which copyright protection may not be important. Other choices include educational, medical, scientific, or welfare-related content. Prices may be attached to the supply of such content subject to governmental regulations. Such a regulatory solution, however, should be considered for a short-term purpose only, since such will always bring distortions and inefficiencies[17].

IV. Competition and Coordination of DTV and the Internet

A. Vertical Structure of DTV and the Internet

In order to realize the benefits of competition and coordination between DTV and the Internet, it is necessary to introduce a business environment in which there is fair competition at a level-playing field. We start with an understanding of the present situation in terms of a vertical structure of the communications industry including DTV, the Internet, telephony, and others.

Figure 3 outlines a vertical structure in the communications industry. The top row lists communications services classified traditionally: telephony, the Internet, cable TV, and broadcasting. In the left column, from top to bottom, we list services classified into vertical layers: content, networking, (physical) media, and infrastructure (structures and spaces). Thus, when e-mail or web pages are transmitted on the Internet, they are first put into the form of IP-packets for networking, and then transmitted via cable such as twisted copper pairs, coaxial cables, or optical fibers. Further, those cables are laid in tunnels, tubes, or between poles, which are constructed in publicly-owned spaces. In the case of broadcasting, the layer structure is simpler; after broadcast content is created, broadcasters (key network stations)

[17] It was also reported in July 2005 that the Information and Communications Council, an advisory board to MIC, recommended that broadcast content be supplied via the Internet to viewers in rural areas in order to speed us the penetration of terrestrial DTV in Japan.

transmit it to local broadcasters, where content is modulated and put on radio spectrum. Spectrum with content emanates from broadcasting antennas to receivers' antennas; the resource devoted for this is the terrestrial spectrum space.

It is noted that the price of information transmission which a consumer pays can be divided into components corresponding to the service of these layers. This is similar to the price of bread, which can be divided into payments to a flour producer, a mill operator, and a farmer producing the wheat. Thus, the vertical layers of the communications industry are nothing but a division of labor viewed vertically. For historical reasons, however, the layer's structure has not received much attention. Telephone operators and broadcasters were born as vertically integrated entities; accordingly, vertical division of activities into layers was not interesting. Once digital technology was introduced into the communications industry, however, the division of activities into vertical layers became interesting and important, since it brought the possibility of vertical division of labor for increasing the overall efficiency, typically seen in the computer industry as the division into hardware and software.

The introduction of DTV brings, from this standpoint, the possibility of a new vertical division of labor in the broadcast industry. The potential benefits from the competition and coordination between DTV and the Internet are one of its consequences.

B. Monopoly in the infrastructure

We observe that the benefits of competition and coordination in the communications industry arise with activities competing (and thus substituting) with each other within a single layer. A classical example is the shift from twisted copper pair to optical fibers in the layer of transmission media. The shift of the means of telephony from traditional voice transmission to new IP-packet transmission is taking place at the layer of networking due to the efficiency of packet transmission over non-packet

transmission. Another example is a change in the distribution of broadcast content from traditional transmission by means of terrestrial spectrum into cable transmission; the reason for this change was the efficiency of the combination of cable with satellite transmission as opposed to transmission relying only on terrestrial spectrum. Most long-distance transmission of broadcast content in Japan at present, however, uses optical fibers.

These examples show that, as a particular service in a layer becomes more economical, the substitution of new technology for old one takes place. This is the basis for the benefits of technological progress to be enjoyed at the level of consumers.

For this reason, we can state that, in the digital world, it is best to promote competition layer-wise. By removing barriers to mutual entries within each layer, we can expect that new technology can be smoothly deployed; in addition, such will encourage further technological progress, ultimately increasing benefits to consumers.

In the following, we shall concentrate on the single most important factor impeding the promotion of layer-wise competition in the communications industry: the monopoly in the infrastructure layer. In Figure 3, the layers are divided into two main groups: competitive and monopolized, as shown in the right-hand column. The double solid lines in the diagram indicate the boundaries between the two groups.

We first note that, in the communications industry, an operator must directly or indirectly use some publicly owned space. In the case of wired transmission, structures for communication such as tunnels, tubes, and poles are constructed by using physical space, which may be land, underground, or underwater. The value of a structure is composed of the cost of the structure itself and the value of the underlying space (e.g., the value of the land) on which it is constructed. When it comes to

wireless communication, the notion of infrastructure is not so clear, since an unseen entity, radio spectrum, is used as a means to transmit information. We can then consider an underlying space to be the terrestrial spectrum space (as opposed to the physical space), in which the transmission takes place. There is no structure such as a tunnel or a cable used for wireless communication; hence the cost of infrastructure for wireless communication arises almost exclusively from the cost of spectrum spaces, which are a scarce resource today.

For historical reasons, the legal and economic basis of the supply of the infrastructure layer is not clearly established, nor is it at a level-paying field with a competitive price. In the case of wired communication, the NTT Corporation supplies a large portion of the communications infrastructure, which was “given” to it at the time of its privatization. There may be an accounting of its infrastructural equipment and underlying spaces, but it is only nominal and departs from the real economic value. For wireless communication in Japan, the right to use radio spectrum is assigned by MIC to users without charging according to real economic values. In the case of the broadcasting industry, in addition, the supply of radio spectrum to certain broadcasters has generated their monopolistic power.

In short, the way in which the services of the infrastructural layer are supplied, in Japan, is far from being competitive or with free entry; vertically-integrated operators such as broadcasters or NTT may freely charge for such infrastructural elements enjoying monopolistic profits or an advantage of internal cross-subsidization in upper-layer competition. In order to promote fair competition on a level-playing field, we need to deal in some way with monopoly in the infrastructure layer.

C. Policies for fair competition at a level-playing field

In this subsection, a proposal will be made for a system by means of which the evils

of monopoly in the infrastructure layer can be minimized by appropriate governmental regulations. The basic idea for this is to regulate the supply in the monopoly layer so that the supply be made as if it were a competitive supply.

In order to do this, we must first distinguish monopolistic services from competitive ones as indicated by the double solid lines in Figure 2. Let us define, for each communications service supplied to consumers (final users), the “monopoly-front service”as that service located at the highest layer within the monopolized group. In Figure 2, the monopoly front for telephony, the Internet, and cable TV are the services supplied in the layer with tunnels, tubes, poles, etc. For broadcasting, the monopoly front is the service of (terrestrial) spectrum. Thus, the level of the monopoly front may not agree among different services. The determination of the location of the monopoly front should be done by the government, considering the degree of monopolistic power of the service in question. In short, when new entry is possible, the service should not be included in the monopolized group. Hence, in the long run, the location of the monopoly front may change dependent on the possibility of new entries.

The basic idea of introducing the concept of a monopoly front is to regulate the supply of the services located on or below it at the front level so that the monopolized group function as if it were a competitive group. This can be done in the following way by means of governmental regulations.

First, the government should regulate each operator so that monopolized services, such as communications infrastructure, be vertically separated from competitive ones, regardless whether the infrastructure is wired or wireless. The separation may be structural in the sense that a vertically integrated operator is divided into two operators, or it may be of accounting without actually dividing the operator. In either case, there should be no regulation on competitive activities. In contrast to this, the

supply of monopolized activities, in particular the supply of services in the monopoly front, should be regulated in the following way.

Consider the short-run behavior of the monopolistic operator in supplying a monopoly-front service. First of all, the supply of a monopoly-front service must be open to all purchasers without discrimination. If the monopolistic operator, supplying the monopoly-front service, is structurally separated from competitive operators, then fair transactions in the market of the monopoly-front service can be realized as long as the monopolistic operator observes the "rules of market conduct." If the monopolistic operator is separated from competitive activities in accounting only, this requirement implies that the operator must, in addition to the above, publish the internal price of the monopoly-front service, and offer it to outside purchasers at a price equal to that used for internal transactions. We call this "no discrimination requirement."

The second requirement in the supply of a monopoly-front service is that the monopolistic operator must act as a price taker. This means that the monopolistic operator first determines the quantity of the monopoly-front service to be supplied for a time period (e.g., a year), and then sell it at a price with which the demand for it is equal to its (fixed) supply. The monopolistic operator is not allowed to withhold a portion of the monopoly-front service in order to raise the price; this means that the operator is prohibited from charging a monopolistic price. We call this "the price-taker requirement." See Figure 4.

It is clear that the two requirements imposed on a monopolistic operator by the government enforce a monopoly-front service to be supplied at a price at which the demand for, and the supply of, the service is equal, i.e., at a competitive price. Such a price of a monopoly-front service includes all the costs incurred to its layer and to the

layers lower than that. The price of a monopoly-front service will be high in urban areas in which the demand is high, while the price in rural areas may not be high. In short, the price of a monopoly-front service shows the value of the communications infrastructure.

If the infrastructure in the communications industry is supplied competitively in the sense described above, then the evils of monopoly such as internal cross-subsidization are effectively removed and, as a consequence, operators in the competitive layers are assured of a level-playing field.

Most of the difficulties and the complexities in the communications industry arise from the fact that every activity in it must use, directly or indirectly, the service of some infrastructure (including space), which cannot be supplied competitively without governmental regulations. Thus, the requirements imposed on the monopolistic operator make it possible for competitive operators in the communications industry to behave as if they were in a competitive environment. In short, the requirements are a way to transform the communications industry, which cannot operate competitively without governmental regulations, into one similar to other industries in which no monopolistic element exists. Figure 5 summarizes the situation of the communications industry, including DTV and the Internet, after separating it into the competitive and monopolistic layers.

The remaining portion of this subsection will be devoted to the discussion of the long-run behavior of a monopolistic operator. It is how the monopolistic operator should construct and maintain the infrastructure under his control. The short-run behavior of the monopolistic operator is to simulate the working of a (short-run) service market. In the same way, the behavior of the monopolistic operator with regard to the construction and the management of the infrastructure, in the long run,

should be to simulate the working of the competitive capital market. Thus, the monopolistic operator should invest in constructing additional communications infrastructures whenever the expected rate of return from it is greater than the expected interest rate to be paid on the fund needed for investment. The monopolistic operator is *prohibited* from maximizing the rate of return from the investment, exactly for the same reasons as the operator is prohibited from maximizing profits (by means of imposing a monopolistic price). In this way, the evils of monopoly will be removed in the supply of the communications infrastructure in both the long and the short run.

A form of organization fitting the behavior required of a monopolistic operator may be a “public corporation,” for which the main objective is not maximization of profit or rate of return, but simulation of competitive behavior in the short run and in the long run. Competition may be introduced among such public corporations, but they should be evaluated in terms of how they simulate competitive markets, not on how well they make money. Observe that it is possible for the government to encourage investment in a particular communications infrastructure, if so chosen, by means of a subsidy on interest payments given to the monopolistic operator managing it.

The following is a list of policy recommendations for promoting competition and coordination between the Internet and DTV. First, the supply of the infrastructure for data transmission on the Internet should be reformed to satisfy the monopoly-front and the price-taker requirements. For example, if a telephone operator supplies optical fibers to Internet operators, then his activities should be divided, at least in accounting, into competitive and monopolistic ones. Further, the supply of structures such as tunnels, conduits, or pole spaces (in case fibers can be constructed freely so that the supply of structures is at the monopoly front) should follow the price-taker requirement.

Second, the supply of broadcasting services should be reformed to satisfy the monopoly-front and the price-taker requirements. Consider a case in which the supply of spectrum for broadcasting is at the monopoly front. Then, in order to satisfy the two requirements, it is necessary to supply spectrum competitively to broadcasters without discrimination between incumbents and newcomers. A way to do this is to introduce competitive lease of spectrum to broadcasters possibly with auctions on lease prices at its initial and renewal assignments[18].

Once such policies are implemented, then the distribution of DTV content can be made competitive and on a level-playing field. In particular, a broadcaster can choose and combine both wireless and wireline means to supply DTV content. An Internet-service provider can also work wireless and wireline. Further, the content provider (producer) can choose and combine the service of a broadcaster and that of an Internet operator. Competitive prices will be formed for alternative means of transmitting digital content; technological advances, not regulatory or monopolistic factors, will be the main determinant of change in such a competitive environment. Thus, the activities of broadcasters and Internet operators will be directed by technological advances; this in turn will encourage technological advances. In this way, we can expect that the welfare of consumers are increased through coordination and competition between DTV and the Internet.

[18] It may be necessary to protect the investment made by an incumbent broadcaster at a renewal auction. See Oniki [2002].

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