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Provision of universal broadband service in Japan: A policy challenge toward a sustainable ICT infrastructure

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Abstract:

This presentation outlines a proposal for a new framework for the provision of universal service aimed at solving the various issues inherent in community informatization, and goes on to look at the advantages and disadvantages of the proposed framework and review its feasibility. In order to ensure that telecommunications services are universally accessible, in less favored areas, universal service is currently provided for analog landline telephones by using a universal service fund system to supplement a portion of costs of the qualified telecommunications carriers. With the development of optical networks, optical IP phones have also been included as a technology for which universal service is provided, but at the same time dependence on landline phones is decreasing due to the popularity and convenience of cell-phones. As this is accompanied by developments such as the fact that almost 100% of Japanese households now have broadband access, there is a pressing need for radical review of the system from a technical perspective. Additionally, given that consumers' organizations and other bodies strongly oppose the fact that carriers pass on the burden of their universal service fund contributions so that the full amount of contributions is shared between telephone number users, it is also necessary to reconsider the approach to how cost burdens are shared. At the same time, while 2.5 GHz band regional Broadband Wireless Access (BWA) has been made available for providing broadband in rural areas, its level of usage is low and ensuring its utilization is a matter of urgency. This presentation will deal with these issues collectively, and propose a framework for maintaining and developing community informatization.

Keywords:

Universal service, less favored areas, community informatization, regional broadband, regional BWA

1. Defining the issues

Japan's information and communications infrastructure developed rapidly from the 2000s onward, and now boasts globally cutting-edge rates of development. According to the Ministry of Internal Affairs and Communications (2013), more than 99.4% of Japanese households have ultrahigh-speed broadband access as of the end of March 2013. Moreover, the Ministry of Internal Affairs and Communications (2014) also recorded that, as of the end of November 2013, the percentage of the population with cell-phone coverage has reached 99.97%.

At the same time, the provision of basic telecommunications services under the universal service system is stipulated in the Telecommunications Business Act[1], with the aim of ensuring the provision of telecommunications services which are accessible nationwide for all citizens. In Japan, universal service must fulfil the following three basic requisites:

(1) "Essentiality": being essential to the lives of the people of Japan

(2) "Affordability": being affordable for everyone

(3) "Availability": being available everywhere, without disparities between regions

At present, Nippon Telegraph and Telephone East Corporation and Nippon Telegraph and Telephone West Corporation (hereafter referred to collectively as "NTT East and West") are specified as the qualified telecommunications carriers, and analog telephone services have in practice been provided as a universal service. In Japan, universal service is the term used to describe guaranteeing that the minimum required communications services are accessible even in less favored areas, that is, high-cost

[1] Telecommunications Business Act (Act No. 86 of 1984), Article No. 7

areas. This differs from the use of the term in the United States, where universal service is aimed at the provision of widespread social security.

A system has been adopted so that the costs of providing universal services are partially supplemented by a universal service fund. Every year the amount that needs to be supplemented by the fund is calculated. This is then divided into an amount per electrical communication number, and allocated to each carrier according to the volume of numbers used by their respective users. However, telecommunications carriers cover this cost by sharing the entire amount between their users, and while this results in only a small fee of around a few yen per month for each user, consumers' organizations and other bodies deeply oppose the charge.

The universal service system itself was created on the premise of the so-called “telephone,” and it does not include cell-phones and broadband which have been appeared in more recent years. As of the end of March 2014, there are approximately 140 million cell-phone contracts in Japan (Telecommunications Carriers Association, 2014), and, as will be shown later, almost 100% of Japanese households have broadband access. Furthermore, conventional analog telephone facilities are becoming increasingly more dilapidated, and are anticipated to be replaced with optical fibers and other technology in the near future. As a result, optical IP phones are also included as a service provided under the universal service system when calculating the universal service fund, but this is largely for the purpose of supplementing the decrease in analog telephone subscribers, and is not aimed at facilitating migration to the optical network. The current universal service system can be said to have played an adequate role in the process of facilitating the widespread use of telecommunications, but as technology becomes ever-more advanced, there is a pressing need to switch to a new system.

With this in mind, this paper outlines various information and communication issues regarding less favored areas, and proposes a new framework which is aimed at maintaining information and communications infrastructure in less favored areas without relying on users sharing the costs.

2. Various issues surrounding communications in less favored areas

(1) Definition of less favored areas

The Ministry of Internal Affairs and Communications (2003) defines less favored areas as areas to which any of the following seven laws apply:

1. Act on Special Measures for Promotion for Independence for Underpopulated Areas
2. Remote Islands Development Act
3. Act on Special Financial Measures for Comprehensive Development of Public Facilities for Distant Areas
4. Peninsular Areas Development Act
5. Mountain Villages Development Act
6. Act on the Promotion of the Improvement of Basic Conditions of Agriculture, Forestry and Other Business in Hilly and Mountainous Areas
7. Act on Special Measures concerning Countermeasures for Heavy Snowfall Areas

However, in the context of information and communications infrastructure development, it is more appropriate to define less favored areas as areas which are unlikely to provide business incentives for carriers due to their low population concentrations and high costs. More specifically, universal services are focused on areas defined as high-cost

areas where subsidies need to be applied, such as areas which under the current benchmarking methods have costs which are equal or higher than the national average cost plus twice the standard deviation, or, areas which fall within the top 5%.

(2) The various issues surrounding communications in less favored areas

Less favored areas generally have a low population density and progressively aging populations, and limited demand for advanced telecommunication in the first place. However, telecommunications sufficiently ensure the minimum communication capabilities required to support livelihoods, and act as social infrastructure which supports the local residents. The question of how telecommunications in such regions can be supported in line with the progress of technology is still an important theme in telecommunications policy.

The issues concerning information and communications in less favored areas are as follows:

1. Universal service and the universal service fund system

The current universal service system covers only landline and optical IP phone technology, and the only carrier which is allowed to provide universal services is the qualified telecommunications carrier, NTT East and West. The system cannot respond to changes in technology and diversification of the market, and there is an undeniable impression that it is behind the times. For this reason, the system was reviewed in anticipation of developing universal service into universal access (Ministry of Internal Affairs and Communications, 2007).

The universal service fund system was established in order to ensure that all carriers provide financial support for the provision of universal service. As this

subsidy is provided to the qualified telecommunication carrier, there was opposition from other carriers, but in fact there is stronger opposition from consumers' organizations regarding the fact that carriers are permitted to directly pass on the full cost to telephone number users. For this reason, adjustments were later made to decrease the burden on users, such as reassigning a portion of the cost to connection fees. A benchmark method is used to calculate the amount that needs to be subsidized by the fund, but very little objectivity is applied in the setting of benchmarks. With the decrease in analog telephone subscribers, the system itself is becoming difficult to maintain.

2. Termination of analog telephones

With the growing popularity of cell-phones and IP phones, PSTN landline phone subscribers are becoming increasingly scarce. NTT East and West (2010) made the following statement regarding their policy aimed at transition from PSTN to IP networks: "In view of factors such as the shift in demand to IP services and the life of PSTN switchboards, we will commence migration from PSTN to IP networks in ten years' time, that is, in ten years' time, that is in around 2020, with completion expected in around 2025" (NTT East and West, 2010, p.1). As universal service is aimed at providing service for analog telephones (and optical IP phones), it has been left behind by the progress of technology and is also diverging from the wishes of users.

3. 100% dissemination of broadband services

In "Next-Generation Broadband Strategy 2010," the Ministry of Internal Affairs and Communications (2006) set out their policy regarding the development of broadband services in less favored areas and other areas which offer commercial

carriers little potential for efficient investment. The strategy also defined goals to eliminate all areas with zero broadband access and raise the percentage of households with ultrahigh-speed broadband access, such as fiber-optic broadband, to 90% or more by 2010, through such means as constructing a development framework with the cooperation of concerned parties and pursuing progress according to a roadmap, as well as making fiber-optic networks owned by local government bodies and other organizations available for use. These goals were almost entirely accomplished, and in particular the number of households connected to fiber-optic networks exceeded the initial target figure (See Figure 1). On the other hand, the subscription rate is hovering at a lower level in comparison with the coverage rate, and divergence between development and use is a problem.

Figure 1

4. Indefeasible Right of Use (IRU)[2]

The Ministry of Internal Affairs and Communications has pursued initiatives to facilitate the establishment of environments for use of information and communications through means such as the "Subsidy for the Development of Information and Communications Environments," and "provides partial subsidies for the costs of projects by local public bodies to develop ultrahigh-speed broadband infrastructure such as fiber-optic broadband in 'less favored areas,' areas which are unlikely to attract development by commercial carriers" (Ministry of Internal Affairs and Communications, 2012, p.8). In these projects, services were

[2] "It is not possible to cancel a contract without the agreement of the telecommunications carrier who has obtained the right of use" (Reference: Ministry of Internal Affairs and Communications, 2004)

provided and facilities were maintained and managed by carriers who concluded Indefeasible Right of Use (IRU) contracts with the network owners, which obligated the carriers to provide communications services and maintain and manage facilities in return for unconditional and exclusive use of facilities. As the IRU contracts were concluded between carriers and local government bodies, there is very little information regarding their content and current status. The IRU contracts are generally for a period of ten years, and therefore they will be due for renewal in the near future. It is possible that the IRU contracts in regions with few subscribers or low subscription rates may not be renewed. There are also regions which were not subject to IRU from the beginning, where publicly-established, privately-maintained schemes cannot be adopted. Furthermore, even in the regions where IRU contracts are in place, unexpected expenditures may arise, and there are cases in which IRU contracts have become a burden for local governments with limited financial resources.

5. Advancement of cell-phones and elimination of dead-zones

With the widespread use of smartphones and the development of 3.9-generation mobile communication system (LTE) networks, the cell-phone has evolved from a tool for telephone conversations to a comprehensive handset allowing the use of various applications. As a result, there is high demand for cell-phone services, and even higher speed services are required. While data traffic is restricted due to limited radio wave resources, it is possible to provide sufficient broadband environment to small-scale users.

However, in less favored areas with low business potential, there are still cell-phone dead zones. According to the Ministry of Internal Affairs and

Communications (2014), as of the end of November 2013, 99.97% of the population has cell-phone coverage, and approximately 39,000 people and 3,240 communities in Japan are outside of the service area. The coverage rate for LTE services is even lower, and particularly in less favored areas the accessibility of high-speed mobile data services is limited. Cell-phones are becoming an increasingly more essential commodity, and even in less favored areas they are expected to be developed as part of the infrastructure for the livelihoods of the people and societies of these areas.

6. 2.5 GHz regional BWA band

The frequencies 2575-2595 MHz of the 2.5 GHz band are known as the regional Broadband Wireless Access (BWA) band, which up until now has been the fixed regional band used by carriers in each region “to achieve the provision of an affordable alternative to wired lines in less favored areas” (Ministry of Internal Affairs and Communications “Radio Use Website”). Regional BWA band uses Worldwide Interoperability for Microwave Access (WiMAX) standard, and was anticipated to act as a regional service which would contribute to improving regional public services and eliminating the digital divide. However, while 42 carriers applied for licenses in June 2008, since then the number of carriers has increased only very slightly. In order to address means of using the frequency effectively, the Ministry of Internal Affairs and Communications conducted the “Survey on the use of 2.5 GHz Broadband Wireless Access (BWA)” (2012) and “Survey for the diversification of regional BWA systems” (2013), and permitted licenses for WiMAX Release 2.1 and Advanced Extended Global Platform (AXGP) standard wireless stations on the regional BWA band with the aim of making the

transition to a compatible system with high compatibility with TD-LTE. The value of the BWA band has increased dramatically, due to the fact that it is possible to use the full 20 MHz width because a guard band is unnecessary due to synchronization with the adjacent band, and due to the fact that the band is contained in Band 38 (2570-2620 MHz) and is accessible on smart phones.

The BWA band is intended to be used for the improvement of regional welfare, but there are many issues which still need to be addressed, such as the method of allocating the frequency and coordination between the current regional carriers in the case that it becomes possible in the future for national carriers to use this band.

3. Maintaining communications environments in less favored areas

Figure 2 demonstrates the relationship between the issues described above, with universal service at the center. As this shows, the various issues concerning information and communications in rural areas are interconnected and can no longer be solved separately. In particular, in relation to broadband environments, the gap between wired and wireless networks is becoming narrower, and it is becoming ever more important to adopt the appropriate technology to solve rural issues.

Figure 2

It is therefore necessary to establish a universal service system which is aimed at solving these issues in an integrated way. In order to solve the various problems raised in the previous section, in the future the universal service system will need to be able to fulfil the following prerequisites:

1. Secure telecommunications in less favored areas
2. Facilitate the use of broadband
3. Ensure technological neutrality
4. Adopt appropriate technology as suits the circumstances
5. Alleviate the burden on users
6. Cover costs using a method which does not rely on taxes
7. Utilize the scarce radio wave resources effectively (2.5 GHz regional BWA band)

The current universal service system is based on providing services for analog telephones, but due to the aging of the switchboards and other facilities, it is necessary to transfer to a new system in the near future. Japan's transition to digital terrestrial broadcasting provides many insights into how difficult it is to replace a service which should be provided universally with a single technology.

Analog terrestrial broadcasting was stopped on July 24, 2011 (March 31, 2012, in Fukushima, Miyagi, and Iwate Prefectures), and switched to digital terrestrial broadcasting. However, measures to solve viewing difficulty continued after the transition, and are due to be finally finished in the 2014 fiscal year. Measures such as high-performance antenna, CATV subscription, community viewing, relay facilities and repacking have been adopted, but as of the end of December 2013, there are still 33,000 households which are not able to receive terrestrial digital broadcasting. Receipt using "one-segment" broadcasting has been proposed for households where it is not possible to receive terrestrial digital broadcasting due to geographical features and where measures mainly using high-performance antenna are not possible due to problems concerning future running costs.

The example of the transition to digital terrestrial broadcasting demonstrates that a considerable amount of time and funds are required when a universally provided service is replaced with another technology. Moreover, universal provision using only a single technology is extremely difficult, and it is essential to adopt various alternative technologies according to costs and demand.

Furthermore, there is also the idea that cell-phone services should be a universal service, but there are two problems with this. Firstly, the intrinsic mobility of cell-phones is not a suitable condition for universal service. Secondly, designating cell-phones, in other words a specific technology, as the target of universal service would be problematic from the perspective of technological neutrality. If it is determined that the cell-phone is the optimum technology for universal service provision, while at the same time maintaining technological neutrality, cell-phones should be made a means of providing universal service.

4. Proposal for maintaining broadband access in less favored areas

(1) A framework for maintaining a new universal service

This proposal focusses on the economic value of 2.5 GHz regional BWA band in order to create a fund for the purpose of maintaining rural broadband environments without relying on users sharing the burden, in line with the seven conditions given in the previous section. As stated earlier in this paper, the BWA band is intended to be used for improving regional welfare. With this in mind, this is a proposal for a universal service system which maintains broadband environments using the value of the frequency band as a source of funding.

Proposal

Define the 2.5 GHz regional BWA band as the "universal service band" and utilize the economic value of the band as a source of funds for the provision of broadband universal service in less favored areas. Allow national carriers to enter the market and make the carriers which are newly assigned the frequency responsible for providing broadband universal service in their area. Define the broadband criteria necessary in rural areas, and adopt these in establishing and maintaining networks.

(2) The economic value of the 2.5 GHz regional BWA band

Since handsets compatible with TD-LTE have been newly launched for sale, the value of this frequency has increased dramatically. The value of the frequency can be appropriately reflected by conducting an auction, but as auction systems have not yet been introduced in Japan, under this proposal applications for licensing will be accepted with a certain maximum or minimum limit, a comparative review will be conducted to consider such points as contribution to the community, and the frequency will be allotted to the carrier which tenders the best proposal.

At an auction (the 800 MHz & 2.6 GHz Combined Auction)[3] held in the United Kingdom in 2013 for the same frequency band, three frequency bands of the 2.6 GHz band, a total bandwidth of 55 MHz, were assigned to the successful bidder Niche Spectrum Ventures Limited for a total of 201.54 million GB-pounds. According to the exchange rate at the time the result was announced (£=140.7 yen), this is the equivalent of approximately 28.36 billion yen, and according to the exchange rate as of April 30, 2014 (£=172.2 yen), it is equivalent to 34.71 billion yen (See Table 1 (1)).

Moreover, according to related materials from Nomura Research Institute (2013), the

[3] Use: Service neutral (LTE, WiMAX etc. expected); Frequency/block count: 800 MHz band (6 blocks of 2 x 5 MHz each, a total 60 MHz), 2.6 GHz band (total of 190 MHz); Area: National; Licensing period: Unlimited (Also possible to define the period of validity of the license by notification five years in advance once a 20 year period (estimate) has been exceeded), Auction method: Two stage format consisting of the Principal Stage (Simultaneous multiple rounds, etc.) and the Assignment Stage (Individual package bids). (Ministry of Internal Affairs and Communications, 2011, p.3)

values of a 20 MHz portion of the 2.5 GHz band in TDD 15-year licenses estimated according to the comparison method, Administrative Pricing method, and income approach method are 12 billion yen, 34.1-194.4 billion yen, and 22.5-320.3 billion yen respectively (See Table 1 (2)). Table 1 (3) shows precedents for the value of the frequency set by auctions previously held in various countries which are used as the basis of comparison method values.

Table 1 (1)-(3)

(3) Basic principles and policy measures

1. Allocation of licenses and relationship with existing license holders (regional carriers)

Under this proposal, applications for licenses for the allocation of 2.5 GHz will be accepted upon the condition that the applicant will contribute to the provision of universal service in the region the carrier is providing for (or nationally). However, it does not necessarily require the carrier which receives allocation to use 2.5 GHz to provide universal service themselves. Both providing universal service oneself (play) or providing funds for the provision of universal service (pay) are considered as a potential means of fulfilling the obligations. The following can be considered as means of contributing to the provision of universal service:

1. Pay: Contribute to a fund etc. aimed at maintaining universal service
2. Play: Provide universal service oneself
3. Play or pay: Select between contributing to a fund or providing service oneself
4. Outsource: Entrust provision in some or all regions to another carrier, instead

of providing the service oneself.

Which of the above will be made a requirement is a point for consideration in the future.

This proposal states that newly-assigned carriers have the responsibility to provide broadband universal service in their relevant area. However, it is not always necessary for assigned-carriers to use 2.5 GHz to provide universal service themselves. Existing regional BWA carriers who wish to continue business will be left as they are, as Mobile Network Operators (MNO). When a national carrier develops business in the relevant area, they will join as a Mobile Virtual Network Operator (MVNO).[4] Allocation to national carriers will be carried out in allocation units consisting of the nation as a whole, or regional blocks. A comparative review will be conducted, including review of contribution to regional communications, and the carrier which provides the best proposal will be allocated the frequency.

2. Content of universal service

The proposed universal service system will be broadband service, and technology neutral. The broadband specifications required in rural areas will be defined separately. Moreover, the opinions of the relevant regions will be taken into account when deciding the technology (wired, wireless) required in rural areas. However, if regional allocation is conducted, a certain level of uniformity in conditions will be required, as there is a risk that universal service which differs from region to region will create confusion.

As audio phone call is a fundamental service, it will be necessary to continue

[4] In reverse, there is also the idea of making regional carriers MVNO, but as in that case they would receive the wholesale of lines from national carriers, there is the potential for the cost burden to increase, and place the carrier at risk.

providing this service by utilizing technology such as Voice over Internet Protocol (VoIP) or Voice over LTE (VoLTE). As it is not possible to define the regions (high-cost regions) or facilities which should receive financial supplements in the conventional way, that is, on the basis of calculations by the geographical divisions known as message areas which are defined for landline phones, they will be decided separately on the basis of definitions of less favored areas and other conditions. At that time, consideration will also be given to including a scheme to supplement deficit in optical broadband provided under the IRU system. Management of the universal service system will be carried out by the Ministry of Internal Affairs and Communications or an external organization.

3. Relationship with the current universal service system

The existing universal service using analog phones will be operated for the time being by means of the existing fund system, but either a deadline will be set for abolishing it, or, it will be incorporated into the new system by successively converting to IP phones.

(4) Advantages and disadvantages

The advantages and disadvantages of the proposed format are as follows:

Advantages

1. It will be possible to secure a certain level of funding for the provision of universal service.
2. As the cost burden for the universal fund will be a sunk cost for companies, it will be possible to considerably avoid this cost being directly passed on to users.
3. It will be possible to maintain the initial policy goal of using 2.5 GHz regional

BWA band for contribution to the community.

4. It will be possible to effectively utilize 2.5 GHz regional BWA band.
5. It will be possible to apply a variety of technology due to technological neutrality.
6. It will be easy to provide not only phone calls but also broadband access.
7. It will be possible to operate alongside the existing universal service system.

Disadvantages

1. It may be necessary to set minimum and maximum limits on the cost burden.
2. It may not be possible to acquire a sufficient amount of funds to maintain universal service (in particular over time)
3. It is unlikely to act as an incentive for making optical broadband more widespread.
4. If the conditions are too strict, there may not be any applications.

5. Conclusion

This paper set out to propose a new universal service system aimed at providing universal broadband access and to outline one concrete scheme for appropriately reflecting the value of radio waves. It is necessary to conduct very thorough investigation in order to ascertain whether or not the proposed framework is feasible. The proposed framework does not include content that goes beyond the range of duties of the Ministry of Internal Affairs and Communications, but coordination between a number of different divisions and sections of the ministry will be necessary. Naturally, it will also be necessary to review whether or not the system is legally feasible. It is also expected that (national) carriers who wish to acquire 2.5 GHz regional BWA band will oppose the new cost burden. The framework proposed here assumes that license applications will come from carriers which are prepared to pay for the frequency

because they recognize its value. However, in general terms, there may be opposition to demanding such a burden only from licensees of a certain frequency. Moreover, in order to ensure that the costs paid are used as initially intended, it will be necessary to establish a framework similar to the existing universal service fund system, under which the costs are paid to an independent organization, rather than being paid into the national treasury as is the case for radio wave usage fees.

There is a risk that it will take a significant amount of time to change the existing universal service system itself, but the framework recommended in this proposal can be adopted alongside the current system without causing any problems. Therefore, as there is a pressing need for the 2.5 GHz band to be effectively utilized, having firstly reached a consensus that 2.5 GHz will be made the “universal service band,” it will be necessary to adopt flexible approaches, including conducting the allocation of the frequency at an early juncture.

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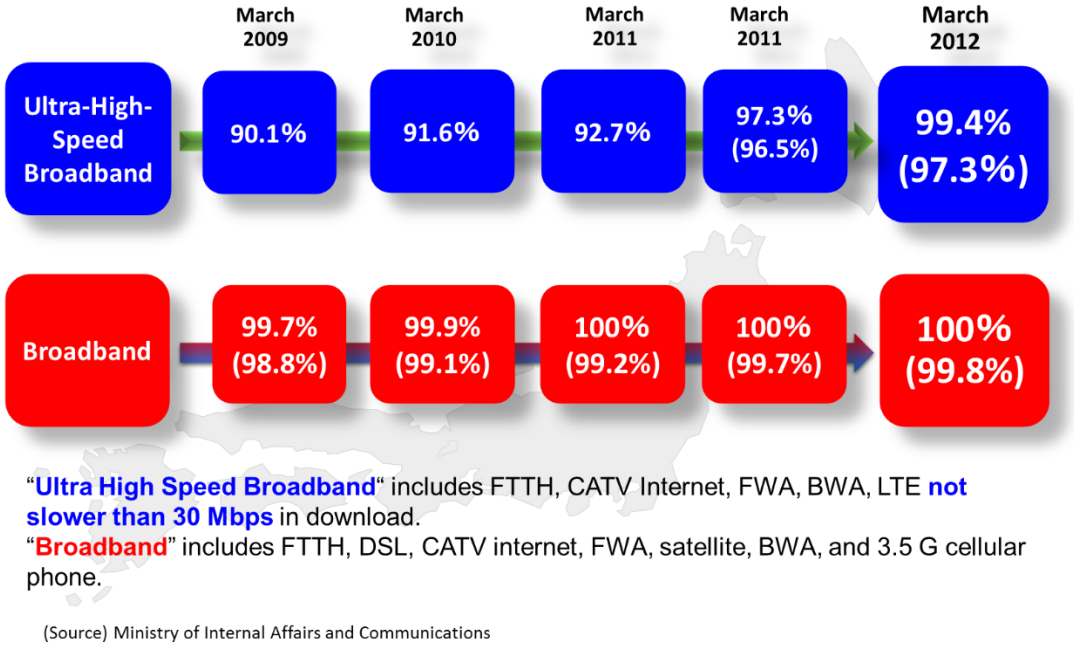
Figure 1: Estimated Area Coverage of Broadband for Households in Japan



(Source) Ministry of Internal Affairs and Communications

Figure 2: Correlation Diagram of Problems regarding Regional Telecom Environment

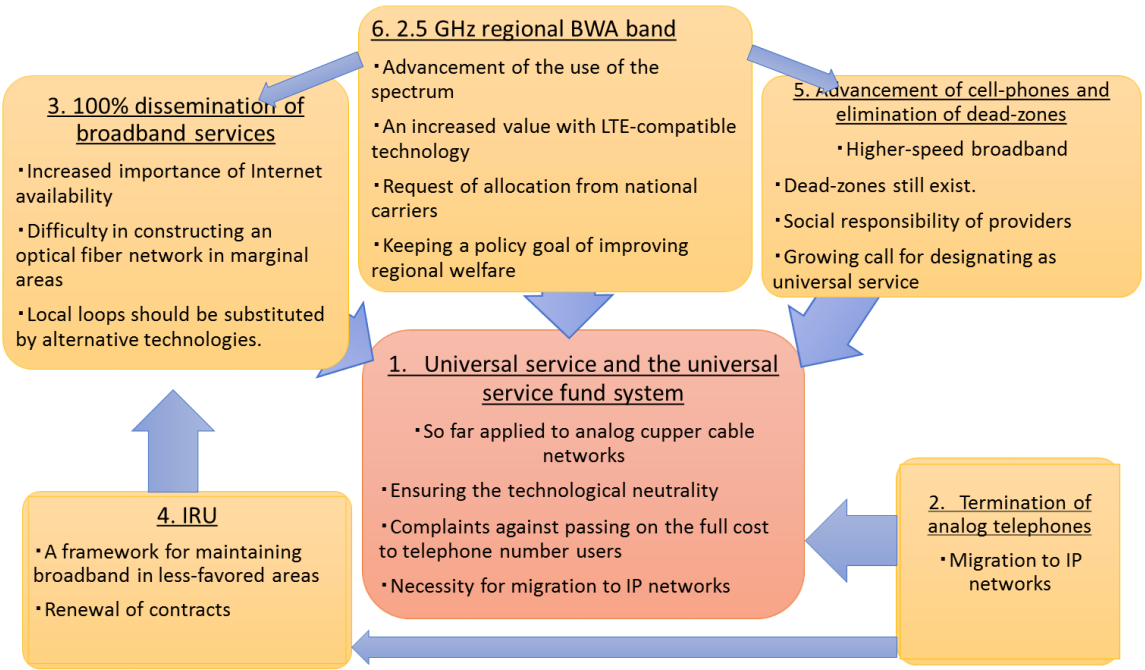


Table 1(1): The Result of Auction of the 800 MHz and 2.6 GHz Spectrum Bands

The Winning Bid by Niche Spectrum Ventures Limited	Frequency Bandwidth	The Total Amount of Bids	The Value for 20MHz
2520 to 2535MHz and 2640 to 2655MHz	55MHz	£201.54million (JPY3.471bil.)	£73.28 (JPY12.62bil.)
2595 to 2620MHz			

Source: Ofcom (2013)　The exchange rate as of April 30, 2014 is applied.

Table 1(2): The Value of 2.5GHz Band

2.5GHz Band TDD 15-Year License	¥/MHz/pop	The Value for 20MHz	
Benchmark Method	¥5 (¥3-6)	JPY 1.20 billion	
Administrative Pricing Method		JPY34.1-194.4 billion	An Estimated Value of 20MHz in 2.5GHz Band
Capitalization Method		JPY22.5-320.3 billion	An Estimated Value of 20MHz in 2.5GHz Band

Source: NRI (2013)

Table 1(3): The Winning Bids for a 2.5GHz TDD 15-Year License

The Timing of Auction	Country	¥/MHz/pop
2011.12	Portugal	1.84
2011.11	Belgium	5.91
2011.09	Italy	5.70
2010.05	Germany	2.19
2009.11	Finland	0.51
2008.05	Sweden	5.08
2007.12	Norway	7.29

Source: NRI (2013)