Investment in Broadband Infrastructure: Impacts on Economic Development and Network Neutrality

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Abstract

Owing to the series of initiatives taken by the Japanese government, coupled with private investments, Japanese people can now enjoy the most advanced broadband environment. The broadband infrastructure has opened a wide range of business opportunities and resulted in huge economic benefits. It has also helped in solving problems and overcoming inefficiencies in various socioeconomic activities. At the same time, such new infrastructure has posed new challenges for the current as well as the future telecom regulators. This presentation will first briefly review the developments of Japanese policy initiatives and then explain the benefits and challenges of such infrastructure developments. This discussion will shed some light on the network neutrality “issue,” which is a result of the dramatic increase in IP traffic over broadband infrastructure, as well as on the fair competition issue between next generation networks (NGNs) and the Internet. The presentation will conclude with some policy recommendations on these issues.

1. Introduction

Rome was not built in a day. Japan has developed its current world-class broadband infrastructure by investing huge amounts of time and money. In 2000, it became apparent that Japan was lagging far behind other developed nations in terms of the IT revolution. As Fig. 1 indicates, Internet penetration was below the OECD average. Moreover, the number of users having broadband access was far lower than that in the US and Korea; most of the users were using dial-up connections or ISDNs, both of which are narrowband. Japan had also lagged behind in the business and public sectors. In an environment of rapid technological development, it was widely believed that “Japan’s current tardiness in embracing the IT revolution may result in an irreparable gap in competitive advantages in the future” (IT Strategy Headquarters, 2001).

The Japanese government concluded that such backwardness was caused by institutional factors, such as high communication fees, restrictions on the use of networks, lack of competition among telecom operators, and outdated legal framework from the “pre-Internet” era. In order to tackle these problems, on July 7, 2000, the “IT Strategy Headquarters” as well as “IT Strategy Council” were established. “Basic IT Strategy” was finalized on November 27, 2000; “Basic Law on the Formation of an Advanced Information and Telecommunications Network Society (IT Basic Law)” was passed on November 29; and on January 6, 2001, “Strategic Headquarters for the Promotion of an Advanced Information and Telecommunications Network Society (IT Strategic Headquarters)” was established within the Cabinet. The IT Strategic Headquarters initiated a series of information and communication technology (ICT) initiatives (Fig. 2).
The NTC International Year End Conference 2008 on the Formation of an Advanced Information and Telecommunications Network Society (IT Basic Law)” was passed on November 29; and on January 6, 2001, “Strategic Headquarters for the Promotion of an Advanced Information and Telecommunications Network Society (IT Strategic Headquarters)” was established within the Cabinet. The IT Strategic Headquarters initiated a series of information and communication technology (ICT) initiatives (Fig. 2).

**Fig. 1:** Subscribers per 100 inhabitants as of January 2000

Source: OECD (2001)

**Fig. 2:** A series of ICT initiatives taken by the Japanese government

Source: MIC homepage

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This presentation will first briefly review the developments of Japanese policy initiatives and then explain the benefits and challenges of such infrastructure developments. The discussion on these challenges will shed some light on the network neutrality “issue,” which is a result of the dramatic increase in IP traffic over broadband infrastructure, as well as on the fair competition issue between NGNs and the Internet. The presentation will conclude with some policy recommendations on these issues.

2. Initiatives taken by the Japanese government

The pioneering effort in the series of the initiatives is the “e-Japan Strategy” which was defined on January 22, 2001. In this initiative, a policy target was defined as follows:

“We will strive to establish an environment where the private sector, based on market forces, can exert its full potential and make Japan the world’s most advanced IT nation within five years” (IT Strategy Headquarters, 2001)

In order to attain this target, four groups of policies were adopted: (1) development of broadband network infrastructure, (2) establishment of rules for e-commerce, (3) introduction of e-government, and (4) human resources development. As for the first group, the policies aimed to cover 30 million households (HH) by high-speed constant access to the Internet and 10 million HH by ultra high-speed constant access to the Internet, before 2005.

Due to a fortunate miscalculation, this target was attained 3 years ahead of schedule. As of October 2002, DSL and cable Internet covered 35 million HH and 23 million HH, respectively. In addition, ultra high-speed fiber to the home (FTTH) covered 16 million HH.

As compared to the advancement of broadband coverage, actual subscription had not grown substantially. In March 2003, 7 million HH used DSL and 2 million HH used cable Internet. There were only 0.3 million FTTH subscribers. In order to boost the actual utilization of such broadband infrastructure, on July 2, 2003, “e-Japan Strategy II” (IT Strategy Headquarters, 2003) was adopted.

The “e-Japan Strategy II” targeted to realize an energetic, worry-free, exciting, and more convenient society through the strategic utilization of IT. As part of this strategy, seven sectors were designated as leading areas for IT utilization and were given special attention. Such areas include medical services, food, lifestyle, small and medium-sized enterprise (SME) financing, knowledge, employment and labor, and public service. Moreover, in order to build new infrastructure for the IT society, the strategy stressed the development of a ubiquitous network, the improvement of security and reliability of the IT, the promotion of research and development, and the encouragement of human resources development.

In order to realize a ubiquitous and universal network society where everyone can enjoy the benefits of IT by FY 2010, “New IT Reform Strategy” was defined on January 19, 2006 (IT Strategy Headquarters, 2006). This strategy has three aims to be achieved by 2010 as follows: (1) the pursuit of IT structural reform capabilities, (2) development of IT infrastructure, and (3) provision of valued information to the world.

In concert with the above initiative by the government as a whole, the Ministry of Internal Affairs and Communications (MIC), which is in charge of the telecommunications policy, adopted the “u-Japan Promotion Program 2006” on September 8, 2006. According to the MIC’s homepage\(^3\), “u” represents ubiquitous, universal, user-oriented, and unique. This program aimed to make Japan the world-leading ICT nation by 2010 and included four policy packages (Fig. 3).

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\(^3\) [http://www.soumu.go.jp/menu_02/ict/u-japan_en/new_outline03.html](http://www.soumu.go.jp/menu_02/ict/u-japan_en/new_outline03.html)
3. Japan’s broadband infrastructure

Owing to these initiatives and corresponding efforts by the private sector, Japan has successfully become the world-leading “e-nation.” People living in Japan can now enjoy the most advanced broadband environment. Such a broadband infrastructure has opened a wide range of business opportunities and resulted in huge economic benefits. Fig. 4 summarizes this development in broadband infrastructure and its actual usage.

- Coverage of broadband Internet

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<tr>
<td>DSL</td>
<td>93.9%</td>
<td>95.2%</td>
<td>98.3%</td>
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<td>+Cable</td>
<td>47.33 mil. HH</td>
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- Actual usage

![Graph showing broadband Internet usage]

Source: MIC (2008a, b)

Fig. 4: Achievements of Japan’s efforts

From the international viewpoint, these achievements may not seem very impressive. In fact, among OECD nations, Japan ranks 15th in fixed Internet penetration and 11th in broadband penetration (OECD 2007). However, when the quality of broadband access is taken into consideration, a different picture emerges: Japan is by far the leading nation in the world (Fig. 5), and people living in Japan enjoy the least expensive Internet access, $0.07 per 100 kbps as of 2006 (ITU 2006).

According to the MIC (2008a), based on this strong foundation, in 2005 Japan acquired $738 billion from the telecom market, which includes $247 billion from the content/application service, $17 billion from the platform service, $198 billion from the communication service, and $276 billion from the equipment market. The MIC also estimates that there will be negligible growth in the communication market; on the other hand, the upper layer market will grow significantly.

In addition, such ICT infrastructure or ubiquitous network has contributed significantly to Japan’s economic development. According to the MIC (2007a), ubiquitous networks are making a positive contribution to the enhancement of productivity, and its impact has been increasing. If the Japanese economy grows smoothly and the potentials of ubiquitous networks are fully utilized, the real GDP growth rate will be about 1.0 to 1.1 points higher than otherwise (Fig. 6).

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**Fig. 5: Broadband leadership matrix**

![Broadband leadership matrix](source: Presentation material by Oxford SAID Business School (2006)⁵)

**Fig. 6: Economic contribution of ubiquitous networks**

![Economic contribution of ubiquitous networks](source: MIC (2007a))

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⁵ [http://www.sbs.ox.ac.uk/downloads/Broadband_Quality_Study_press_presentation.pdf](http://www.sbs.ox.ac.uk/downloads/Broadband_Quality_Study_press_presentation.pdf)
1. Intrinsic problems of Internet technology
2. Problems from “exaflooding” of the IP traffic
3. Issues pertaining to the development of ubiquitous networks
4. Challenges from various terminal equipments
5. Concerns of security and reliability

Among these, the problems from “exaflooding” of the IP traffic can have the most enduring and grave impact on broadband infrastructure.

Cisco Systems (2008a) forecasts that “annual global IP Traffic will exceed half a zettabyte in four years,” and “global IP traffic will nearly double every two years through 2012. Total IP traffic in 2012 will be six times larger than it was in 2007, and four times larger than it is this year.” “The Internet in 2012 will be 75 times larger than it was in 2002. Internet traffic will generate 27 exabytes per month in 2012, the equivalent of nearly seven billion DVDs each month.” (p.1) (Fig.7)

Many experts say that in the near future, this dramatic increase in IP traffic may saturate the current broadband infrastructure and cause bottlenecks for various e-activities. On the other hand, the paucity of network capacity, or its possibility, raises concerns about the anticompetitive/antidemocratic behavior of such bottleneck providers. This is the so-called network neutrality issue.

Although this concept is applied in many varying contexts⁶, problem-setting for policy makers can be divided into two categories: short term and long term. In the short term, the challenge is how to maximize static efficiency. In other words, the problem that policy makers have to deal with is how to properly discipline incumbent network operators who control bottleneck facilities. This problem actually consists of two sub-problems: one (task 1) is how to prevent the anticompetitive behavior of the operators, and the other (task 2) is to motivate the operators to utilize their existing resources efficiently. The latter task involves determining to what extent the operators are allowed to manage their own networks. The majority of network neutrality debaters on both sides agree on the necessity of such management, but they significantly disagree on what is considered “reasonable”; this is the focal point of discussion in the Comcast case in the US. Competition is the key to deal with this short term issue. That is, as long as the ISP market is sufficiently competitive, task 1 is not a major concern. Further, when many ISPs with different network management policies compete with each other, “reasonable” management will prevail in the end. Thus, task 2 also is not a major

⁶ There are at least 6 dimensions to this concept that is currently debated: economic/noneconomic, long-term/short-term, fixed network/cable or mobile network, single-sided market/two-sided market, etc.
issue under competitive markets. From this perspective, because NGN can provide highly secured and QoS-guaranteed IP transmission that is vertically integrated with some upper layer functions, it is important to introduce the fair competition requirement in NGN in order to maintain a competitive ISP market.

On the other hand, the long-term problem is how to motivate network operators to deploy the optimal network capacity. Based on a survey conducted in 2007 by the author among Japanese broadband users, each subscriber would be willing to spend between 452.1 yen ($4.46) and 1,064.6 yen ($10.50) as a monthly surcharge for upgrading the network infrastructure. It is then concluded that if the current exaflooding continues, the amount of such “possible” resources would run short within two to three years (Fig. 8).

5. Conclusion

What we have learned thus far can be summarized as follows:
► It seems that the government initiatives have significantly contributed to making Japan the world-leading “e-nation,” where people can enjoy the most advanced ICT environment. Further, large-scale business activities are supported by the advanced IT infrastructure, and the development of ubiquitous network can have a significant impact on the nation’s economic development.
► However, such well-developed infrastructure poses its own challenges. In particular, a dramatic increase of IP traffic would raise concerns of network neutrality. In the short term, competitive policy would solve the optimal resource utilization problem. Moreover, in the longer term, new business models or more governmental spending will need to be introduced. It is also important that fair competition with NGN be secured through significant market power (SMP) regulations.

unbundled/bundled, and legal use/illegal use.
References