7.1 A Personal History Related to the Internet in Japan

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Around 1980, Tadao Umesao [1] and Alvin Toffler [2], in their futurology, predicted that static social memories before the *Third Wave* would be vitalized by data processing and communications between machines, finally metamorphosing into an intelligent (aka information) environment. They emphasized that we should not only accept information but also create and renew it constantly. Their future society, where an information environment replaces a market and acts as an intermediary between people, has already begun. Now we know it has been triggered by the widespread use of social networking and other services over the internet.

In the early days of the internet, various regulations, including those that now seem amusing, existed as obstacles. It must be remembered that the internet has become a service by persistently overcoming such obstacles one by one. Here, from my personal experience in Japan over the past 40 years, I discuss some of these regulation amendments that were implemented to cope with the rise of the internet.

1. A Fuss

Until the privatization of Nippon Telegraph and Telephone Corporation (NTT) in April 1985, only telephones developed by NTT could be used for phone calls through public switching telephone networks (PSTNs). However, the idea of using PSTNs for data communication became obvious even in the 1960s. After NTT opened its PSTN to data communication in November 1972, various data communication terminals could be installed and operated by users if those devices were certified by NTT as conforming to its technical standards. This was due to the commercialization of facsimile machines in Japan in the mid-1970s. The facsimile was the first data communication terminal implemented via PSTN. After the privatization of NTT in April 1985, the telephone itself was also liberalized, and the certification of terminal equipment was carried out by the Japan Approvals Institute for Telecommunications Equipment (JATE) instead of NTT. At that time, not only facsimiles but also various telephone network modems, such as the Hayes Smartmodem 1200 based on Bell 212A LSIs, contributed to the liberalization of terminals.

In the summer of 1982, the sales department of Kokusai Denshin Denwa Co., Ltd. (KDD) received a complaint from a major trading company that it could not connect to its American branch office using a newly released modem, and they asked me to resolve this complaint. Accordingly, I bought the Racal-Vadic 1200-bps modem they used, made driver software for it, installed it in a minicomputer (VAX-11 / 780), and decided to conduct UUCP connection experiments with several research institutes in the United States. All of the negotiations were done by airmail in those days, and the round-trip time was usually two weeks. After I exchanged airmail and TELEX messages with Mark R. Horton at AT&T Bell Laboratories in Columbus, Ohio, who was leading work on USENET/UUCPNET in those days, he introduced me three other persons: Gary J. Murakami of AT&T Bell Laboratories at Indian Hill near Chicago (ihnp4), Rick Adams of the Center for Seismic Studies on the east coast (seismo), and Greg Fowler of Hewlett-Packard Laboratories on the west coast (hplabs). Unfortunately, I could not connect to these sites, except for Chicago. This partly came from the fact that international submarine cables early in the 1980s, such as TPC-1 [3] and TPC-2 [4], used coaxial cable systems based on the frequency division multiplexing analog transmission. The link quality varied more than that of modern optical submarine cables. Furthermore, the quality of local subscriber lines varied widely from location to location. Therefore, I conducted further connection experiments after purchasing several modems available in Japan.

As a result, the main cause was found to be the power supply circuit of many imported modems, designed for 115V use, lacking sufficient performance at 100V, even if the voltage specifications were guaranteed. Next, for communications between this trading company and sites in Europe, I conducted an experiment with the University of Kent (ukc) in the United Kingdom. This time, I could communicate with Peter Collinson of ukc by email via UUCPNET to set up the link. After these experiments were completed, I sent my project report to this company with technical data such as suitable modems and voltage boosting methods that would ensure stable communications. We concluded that connecting data terminals via international PSTNs could not provide a universal service for our customers in the mid-1980s.

At that time, I belonged to a project called “Data communications terminals” led by Kazunori Konishi. Since he found promise in PSTN technology, he decided to continue work on it as an “under-the-table” project. At that time, telecommunications carriers around the world were focusing on developing X.25-based data communication services, so data communications via modems on PSTNs were out of their service scope. That was why we started to investigate ways of establishing reliable links with USENET, using our data communication service of X.28 PAD [5]. In July 1983, I knew that Piet Beertema at Centrum voor Wiskunde en Informatica (mcvax), the Netherlands, had developed such a UUCP extension. We verified that the X.28 UUCP connection with mcvax could provide a reliable link, as we expected. Piet Beertema developed a directory service “netdir” using emails [6], the concept of which was helpful for our later project InetClub [7].

Even after the experiment was completed, the links between our VAX-11/780 and overseas were maintained because mailing lists were found to be indispensable to the operation of UNIX machines in our small laboratory. Furthermore, Horton sent me the NetNews software [8], which proved to be very useful in obtaining technical solutions. In today’s terms, NetNews was an SNS that transferred messages by epidemic routing according to newsgroups or content types, and USENET was a service that used it. Newsgroups carried on the type of discussions that are typical of GitHub today. We decided to transfer a small portion of news messages in computer science by online means. In those days, the international call charge between Japan and the United States was 1,530 yen every 3 minutes. Therefore, the number of NetNews messages exchanged by USENET was too expensive to transfer at 1200 bps. Later, in 1983, I knew that Rick Adams at seismo regularly mailed USENET log tapes to Professor Kilnam Chon of the Korea Advanced Institute of Science and Technology (KAIST), so I asked him to mail their copies to Japan, after which I uploaded them to our VAX-11/780.

The VAX-11/780 and SUN workstations were purchased mainly for a speech recognition project, as well as a project to automatically generate a program from the required specifications with Professor Hajime Enomoto of Tokyo Institute of

Technology. Akira Kurematsu, our laboratory manager, initiated these projects. He became the director of ATR Interpreting Telephony Research Laboratories in 1986. It was fortunate that he was a potential user for our "under the table" project before the coming fuss raised at KDD R&D Labs.

The SUN workstation at Tokyo Institute of Technology and the one at KDD were connected by a dedicated line, which happened to be on the same Ethernet as our VAX 11/780. This made it possible for researchers at Tokyo Institute of Technology not only to exchange emails with ARPANET but also to send/receive NetNews messages. Of course, all NetNews messages from KAIST were automatically forwarded to the Japan University Network (JUNET) sites, showing the power of information sharing and open science to many researchers. In particular, two graduate students, Yoichi Shinoda (currently professor at the Japan Advanced Institute of Science and Technology at Hokuriku) and Akira Kato (currently professor at Keio University) became enthusiastic NetNews subscribers. They connected their SUN workstation to the VAX 11/730 of Jun Murai, who was appointed as an assistant professor at Tokyo Institute of Technology after leaving Keio University in 1984. Eventually, the international link of JUNET was established. This was announced officially to the JUNET user community in January 1985; the main international link was that with Centrum voor Wiskunde en Informatica, the Netherlands, via X.28, along with two auxiliary links using international PSTNs (ihnp4 and seismo). The existence of the JUNET gateway for research communities was officially announced in PCCS'85, Seoul, in October 1985 [6].

In those days, the Ministry of International Trade and Industry (MITI) invited many researchers in computer science and artificial intelligence from Europe and the United States to the Institute for New Generation Computer Technology (ICOT), which was launched by MITI in 1982 to develop fifth-generation computers [9]. The need to exchange emails would thus potentially increase dramatically in various research communities. Akira Kurematsu, of course, understood this demand, and he was tolerant of JUNET traffic as the laboratory director of this "under the table" project. However, in 1986, the telephone charges of the KDD R&D Labs exceeded one million yen per month. This problem was revealed when famous university professors thanked Yukio Nakagome, the director of KDD R&D Labs, for this international connection "service" at a social gathering between senior KDD executives and academic experts in the fall of 1986. Accordingly, a fuss was raised when it became clear that executives of KDD R&D Labs had been aware of the details of this arrangement [7].

2. Conflicts with Public Telecommunications Act

Many universities and research institutes welcomed the "accidental" KDD relay of emails to ARPANET. This made it difficult for KDD, a public company, to break these links. In 1984, under the Public Telecommunications Act, only NTT and KDD were permitted to relay communication messages [10]. This meant that the domestic JUNET had been operated illegally. In 1985, this law was modified as the Telecommunications Business Act [11], which permitted certified telecommunications companies to relay messages. However, the issue of JUNET violating the law remained unresolved because JUNET was not considered as such a telecommunications carrier. As for the subset of JUNET that involved academic institutes or universities, the Ministry of Posts and Telecommunications (MPT) permitted Jun Murai to form a network research project, which made it possible for the project members to use their mail system and other resources. This is the legal basis by which JUNET evolved into the WIDE Project, which was launched in 1988.

The international connections for the rest of JUNET, or private companies including ICOT, were more challenging to resolve, since KDD could connect only to foreign telecommunications carriers by law. UUNET, founded by Rick Adams of seismo in 1987, and EUNET, founded at mcvax, were not such telecommunications companies in the mid-1980s, but both of them gained this status in 1990. Kazunori Konishi engaged in tough negotiations with MPT that came to an eclectic solution: establishing a user club, called InetClub, that would allow members to use international links to ARPANET. He then invited Prof. Haruhisa Ishida of the University of Tokyo, a famous researcher in an N1 network project, to serve as InetClub's chairman; he was also chairman of DECUS (Digital Equipment Computer Users' Society), Japan Chapter, which provided a software exchange service among its members by magnetic tapes [12]. Ishida's involvement satisfied MPT, technically as well as from a user's perspective. In May 1987, InetClub was established by Haruhisa Ishida (chairman), Jun Murai (vice chairman), and Kazunori Konishi (executive director) [7]. However, it was technically difficult to strictly limit the relay of messages to/from members, so an invitation to the club was inserted at the end of each mail to each non-member. This might have violated the confidentiality of communications as described in the Constitution of Japan [13]. Fortunately, InetClub was not a communication business company, so this stipulation was not applied to the club.

However, MPT did not permit leased lines for interconnections, which forced InetClub to use only PSTNs. In those days, the Japanese Public Telecommunications Act Enforcement Regulations, as well as CCITT (Comité Consutif International Télégraphique et Téléphonique) Recommendation D.1 [14], prohibited message exchanges in the configurations of a leased line connecting two PSTNs. In 1986, MPT established the Advanced Telecommunication Research Institute International (ATR) [15] for basic research on such technologies as speech translation, neural networks, virtual conferencing using avatars, and intersatellite optical communications. Since a quarter of its researchers were foreigners, MPT probably understood the importance of international communications with foreign research institutes for their new project.

The launch of the AlterNet service by UUNET Technologies in 1990 represented the original creation of an internet service provider (ISP) in the US to provide commercial international connections. The first ISP in Japan was AT&T Jens, a foreign-affiliated company, which started Japan's first commercial ISP service SPIN (UUCP connection) in November 1992, and an IP connection service InterSPIN in October 1993. The first domestic ISP was Internet Initiative Japan (IIJ) [16], which became a Special Type 2 Telecommunications Carrier in February 1994, promoted by Jun Murai and others. In December 1994, InetClub was disbanded by Takao Hotta, the system manager of InetClub, while it still had more than 700 members, many of whom moved on to IIJ.

At that time, the PSTN connection to UUNET using Telebit TrailBlazer modems had become the main link because the UUCP throughput was 20 kbps [17], 20 times faster than that in 1986, and international call charges to the United States were about 70% cheaper than in 1985. The digitization of the relay network was a major factor in the improvement of telephone line quality and the steep drop in charges. For example, international submarine cables had been digitized since TPC-3 in 1989 [4], and TPC-5 in 1995 [4] had a capacity 165 times larger than TPC-2. Even after TPC-5, the capacity increased exponentially with the introduction of Wavelength Division Multiplexing (WDM) and digital coherent optical communication systems.

From the service perspective, legal revisions were required to change the services of NTT and KDD. In December 1996, NTT launched an internet connecting service “Open Computer Network (OCN)” [18]. MPT amended the Regulations for Enforcement of the Telecommunications Business Act in November 1997 for interconnections among ISPs. Consequently, Japan’s internet service network was completed.

3. Ina xDSL Field Trial and Dry Copper Pair Liberalization

Around 1990, my main research area was network management and the development of an expert system for managing KDD’s transmission lines. Based on my experience in handling the InetClub system, I felt a dialup connection service was not scalable since we had a lot of call-handling problems caused by modems, and it was very difficult for non-experts to identify the cause of such problems. I thought this might also increase the operational costs of ISPs. I looked into the possibility of using asymmetric digital subscriber line (ADSL) modems [19] in the mid-1990s to solve this dilemma. The communication characteristics of ADSL were not revealed to the public because NTT was reluctant to adopt this technology, since they planned to install fiber-to-the-home (FTTH) service in the late 2000s.

In Summer 1996, Yasuhiro Hiramiya of Suri Giken (a software development company), who was an active InetClub member, brought me information on how we could make an experiment using xDSL connecting services, since he found a rural operator that used the same copper pair lines and telephone exchanges as NTT used, but on a small scale. I thought this was a good chance to evaluate the service quality of ADSL over NTT’s copper pair subscriber lines. This operator was Ina City Wired Broadcasting & Telephone Agricultural Cooperative (Ina-AINET), a rural operator providing wired broadcasting & telephone services in Ina City, Nagano [20]. Wired broadcasting & telephone service was designed to provide rural areas with audio broadcasting and telephone services over twisted pair copper cables under the Act of Wired Broadcasting & Telephone Service of 1957. In the early stage of constructing PSTN, NTT was unable to install enough infrastructure in those rural areas. This service was known as Noson Denwa, which means “rural phone.” The difference from NTT’s PSTN was that its area of service was restricted, usually within that of the local government.

Yasushi Nakagawa, a board member of Ina-AINET, was positive about our technical experiment and had a vision of his rural phone system serving as an internet-connected media. This was the main reason for the success of our trial. Fortunately, he had just started a dialup connection service to an ISP, Fujitsu InfoValley. Nakagawa introduced me INAJIN, which was an internet lovers’ community led by Akira Urano and had as members Akira Yasue and Tsuyoshi Aruga. Yasue was an employee of Ina City Hall. Two active junior high school teachers, Hiroshi Aruga and Takehiko Asuke, joined this project. This helped us to get support from the local government as well as elementary and junior high schools. We launched the Ina xDSL Field Trial Liaison Committee on July 31, 1997, with Akira Yasue and Iwao Tojo as representative secretaries.

The Ina xDSL Field Trial began on September 1, 1997. It was a small experiment that consisted of 24 ADSL links and 3 high-bit-rate digital subscriber line (HDSL) links shorter than 7.2 km. Nothing was bought, and all that was required was our voluntary labor. Manufacturers and distributors of xDSL systems (Sonet, Paradine, Sumitomo Densetsu, Sumitomo Electric, etc.) provided the project with their xDSL modems and digital subscriber line access multiplexers (DSLAMs) [21], most of which were imported except those from Sumitomo Electric. Yokogawa brought their oscilloscopes to monitor the frequency characteristics of the cables. Our laboratory brought application servers, five CISCO routers, IXIA network analyzers, and several web cameras. Katsuya Takemura of Fujitsu InfoValley set up a 2-Mbps HDSL link to his ISP. Hiroshi Komaki of Ina-AINET was in charge of working on the main distribution frame (MDF) [22], telephone lines, and splitters. Masami Ishikura, Yoshihiro Ito, and Ayumu Kubota of our laboratory set up the routers and servers with Shinji Umeyama of Suri Giken and measured the IP service quality of the overall network. Akira Urano and other INAJIN members made video content for their video-on-demand service. Although NCSA Mosaic had appeared in 1993, there were few HTML writers in Japan. I gave them my introductory textbook on HTML, and they created better video distribution content than expected. This is because they could use, albeit by audio, the broadcasting station facility in Ina-AINET to create video content. Furthermore, they had enough talent. Most of them were amateur radio operators and were using packet radio or AX.25 [23] over the surrounding 3,000-meter-high Japan Alps mountain range. From this point of view, Ina City was the best place for our experiment.

In those days, most ISPs configured their relay networks using 128-kbps leased lines. Thus, the possible results of using 2-Mbps broadband services excited all of the participants involved in this experiment because ADSL allowed this rural network to grow from just providing telephone and audio broadcasting services to providing advanced multi-media broadband services such as TV conferences, video-on-demand services, and many other web-based services that we commonly enjoy now.

The more important outcome was that the investment into the network could be recovered in five years. This was amazing because the payout cycle of telecommunications infrastructure was usually assumed to be 25 years in those days. This means that it was possible to launch the ADSL market before FTTH, which was expected to be available around 2010. Several entrepreneurs attended the progress briefing sessions on our experiment. In particular, Iwao Tojo, CEO of Suri Giken, decided to provide ADSL connecting service throughout Japan. On July 29, 1998, he founded Tokyo Metallic Communications Co., Ltd. (TMC) for this purpose along with Hiroaki Kobayashi of Sonet.

However, lending unused twisted pair cables, or "dry copper pair cables," of NTT to other operators was not possible because this was not defined as a service in the Telecommunications Business Act and its related regulations. With the support of MPT, it became possible to rent these cables as designated telecommunications equipment in 1999. In November of that year, Tojo started the ADSL connection service in Tokyo. However, they had to solve the challenge of installing a splitter to co-locate ADSL modems with traditional phones and MDFs, since the interference between the existing ISDN (integrated services digital network) and ADSL could not be resolved technically—or politically—until May 2003. In the above situation, KDD could not start ADSL service even though it was privatized entirely from a special corporation bound by the KDD law in 1998. KDD entered the M&A era from 1998 up to the establishment of KDDI in 2000. Since KDDI decided not to get into this business, TMC saw its cash flow deteriorate and was acquired by Softbank in 2003. Softbank aggressively pushed the ADSL business, and this market grew to 14.52 million subscriptions by March 2006 [24]. This ADSL business was the first step of Softbank becoming the comprehensive communication service company it is today.

4. Conflict with Copyright Act

From 2001 to 2005, I was president of KDDI R&D Laboratories, Inc. When I became a professor at the Graduate School of Information Science and Technology, the University of Tokyo, in 2006, I found out what had happened after the incident involving Winny [25], a pure peer-to-peer (P2P) file sharing software, at this university. I felt a negative consensus over P2P research within the graduate school. This was an unfortunate event unique to Japan. However, it made me understand that not only technological development but also the development of the accompanying legal system, or the layer above the application layer, is becoming increasingly important in the 21st century.

During this period, the property of ADSL service to always connect terminals to the internet allowed application user groups themselves to freely create their own global networks. In those days, infringements of public transmission rights (transmission enablement right) using WinMX [26] were rampant, and not a few people were arrested for violating the Copyright Act [27]. In 2002, Isamu Kaneko developed Winny. He was an assistant professor in the Department of Mathematical Informatics, Graduate School of Information Science and Technology, the University of Tokyo. Because of its efficiency and enhanced anonymity, Winny was quickly replacing the existing WinMX, and in November 2003, a person who sent works using Winny was arrested for the first time. Because Winny did not have a central server, it was impossible to identify the person responsible for this application service. Instead, Kaneko was arrested by the Kyoto Prefectural Police on May 10, 2004, on suspicion of aiding a violation of the Copyright Act, and then he was charged on May 31. The name of the court case was the "Copyright Act Violation Aid Case."

On December 13, 2006, the Kyoto District Court (Judge Makoto Himuro) convicted Kaneko and sentenced him with a fine of 1.5 million yen and one year in prison. Kaneko appealed to the Osaka High Court. On October 8, 2009, at his appeal trial (Judge Masazo Ogura), the Osaka High Court ruled in its reversal that he was not guilty, and on October 21, the Osaka District Public Prosecutors Office appealed the decision to the Supreme Court. On December 20, 2011, the Supreme Court's Third Petty Bench (Judge Kiyoko Okabe) dismissed the prosecution's appeal. He was acquitted. After that, he became a specially appointed lecturer at the Supercomputing Research Division of the Information Technology Center, the University of Tokyo, but he died at the young age of 42 due to an acute myocardial infarction on July 6, 2013.

The Copyright Act came into force in 1899 and was amended in 1970 for the first time. Since 1983, the Copyright Act has been amended almost every year in line with the rapidly changing society. For this P2P incident, the Ministry of Internal Affairs and Communications (MIC), sympathetic to Kaneko, held the Advisory Panel on Network Neutrality WG from 2006 to 2007. Then MIC ordered the Foundation for Multimedia Communications (FMMC) to set up the Advanced Network Utilization Promotion Council to create guidelines for commercial P2P services and to demonstrate the business model as the industry consensus from 2006 to 2011. As the chairperson, I understood the following: The copyright organization raised issues from the perspective of the Copyright Act, not only with P2P but also with content search, backups of user files by ISPs, and packet duplications at routers. The Copyright Act Amendment in 2009 [28] permitted all of these, including cache servers for P2P. From the perspective of the Copyright Act, this means that Japanese ISPs might have been operating illegally for about 15 years since the start of their business. This was the first incident showing that the internet had become a social infrastructure that a single ministry cannot control. Since then, similar challenges have arisen one after another.

Although the identity of Satoshi Nakamoto, the inventor of bitcoin [29], is unknown, there are rumors in Japan that Kaneko Isamu was actually Satoshi Nakamoto, based on his programming skill, technical knowledge, lifestyle and philosophy of criticizing the regime. If Isamu Kaneko were Nakamoto, the period of his activity would have begun some day between the Kyoto District Court's decision and the Osaka High Court's decision and then stopped one year before the Supreme Court's decision. After that he moved on to the University of Tokyo, which was negative toward P2P research. Despite whether this rumor is true, we lost a valuable researcher due to a misuse of the law.

5. Concluding Remarks

One of the biggest challenges is to make copyright protection legally compatible with the secrecy of communication guaranteed by the Constitution [13]. At the Cabinet Office Internet Piracy Countermeasures Review Council in 2018, there was a long debate over whether to block access to pirate sites, on which content such as manga and anime was illegally uploaded without the consent of the copyright holders [30]. However, it ended without reaching any conclusion. This controversy remains an open question even in 2021.

The next challenge is to make privacy protection legally compatible with the secrecy of communication. In 2003, 23 years after the OECD Privacy Guidelines, the Act on the Protection of Personal Information was enacted in Japan [31]. Regarding the distribution of personal information across national borders, the EU requires that each country guarantee that it is in accordance with the EU General Data Protection Regulation (GDPR). In this way, the pressure on services across national borders may increase in the future. To carry out such guarantees and monitoring, there is a high possibility that the current network architecture violates the secrecy of communication. Of course, new technologies such as Content Centric Networking [32] can solve this problem to some extent, but it will be very difficult to introduce this new content transport system in the current internet from the business point of view. Solving this problem is the cornerstone of big data distribution. However, the legal system established for such issues is currently being reconstructed because the protection of personal information and privacy is a relatively new concept and must be clearly defined.

In the mid-2000s, two technologies appeared that have been having a great impact on our society up to today. One is the 3G mobile network and its successors, and the other is cloud computing. The former implies that not only are mobile terminals connected to the internet but also almost everybody in the world can now use the internet. In particular, the number of Asian users has increased sharply in the market. This is the reason why previously failed services and technologies such as FinTech have been revived. FinTech itself has a lot of legal issues right now, but in this article I focus on the more important issue of gig work, which is a result of connecting people in the real world. For example, ride sharing consists of a driver as a gig worker, passengers, and an intermediary such as Uber, where the driver pays part of the passenger's payment to the intermediary as an agency fee. In considering the National Tax Collection Act [33], let us refer to the US trial [34] in which it was in dispute whether the driver was a part-time worker (using Form w2) or an independent contractor (using Form 1099). The operating revenue of Japan's taxi business nationwide in 2015 was about 1.7 trillion yen [35], and it is estimated that a consumption tax of approximately 136 billion yen was collected by the government of Japan. If a driver is regarded as a contractor and the driver's annual sales are less than 10 million yen, he or she is not obliged to pay the sales tax [36]. Sales tax is charged only on an agency fee, which means that the total sales tax revenue from taxi service will drop sharply. The corporate tax revenue will also drop sharply. Considering the rise of intermediary services that connect consumers with sellers of services and products, it is necessary to review the tax incentives for small businesses.

Furthermore, the driver or gig worker must pay all social insurance premiums. On the other hand, if they are employees, they only have to pay half of them. Thus, they will newly form the lowest class among part-time workers in our society. This will become a large national risk to our future society. Consequently, the Labor Standards Act [37] must evolve along with other acts, including the National Tax Collection Act, depending on the evolution of the internet.

The next technology that has had a great impact on our society is cloud computing. Its underlying technologies are computer virtualization and high-speed networking, and computer manufacturers and telecommunication equipment manufacturers, respectively, have made efforts to develop these technologies. However, it is well-known that Amazon has already been successful in service provision. Cloud computing has many advantages, such as ample computing power and reduction of operating costs. However, issues of taxation and corporate valuation have arisen [38]. Examples include the difficulty of corporate tax collection and the change in journalizing of computers on financial statements from tangible fixed assets to expenses (subscription). Moreover, in companies like GAFA (Google, Amazon, Facebook, Apple), although data assets are the largest resource of corporate value, they are not journaled as intangible fixed assets; therefore, corporate value cannot be evaluated from their financial statements. As the number of such companies increases, the investment environment and taxation system need to be changed to accommodate this type of new business as soon as possible. Furthermore, cloud computing makes it possible to move the company's core functions not only to another place within a country but also to anywhere in the world in a few hours.

We need to design regulations and technologies to make the cross-border activities of enterprises and the internet coexist with nations that seem closed within their own borders. This will be the most important and also the final cyber-physical issue left to us. The internet is becoming the intersociety.

References

[1] Tadao Umesao, "Information Civilization - Value Transformation in Human History," Chuuoukouron, vol.103, no.2, pp.152-172, February 1988.

[2] Alvin Toffler, *The Third Wave*, William Morrow & Co., New York, Mar. 1980.

[3] Engineering and Technology History WIKI, Milestones: TPC-1 Transpacific Cable System, 1964. Retrieved 2021-05-05.

[4] Wikipedia, Submarine communications cable, 2021, Retrieved 2021-05-05
[5] ITU, “X.28: DTE/DCE interface for a start-stop mode Data Terminal Equipment accessing the Packet Assembly/Disassembly facility (PAD) in a public data network situated in the same country,” Recommendation X.28, December 1997. Retrieved 2021-05-05.
[6] Jun Murai and Tohru Asami, “A Network for Research and Development Communities in Japan -JUNET-,” Proc. of First Computer Communications Symposium, pp.579-588, Seoul, 1985.
[7] Mokoto Takita, Network Genesis - Trajectories of Men on the Internet -, Jitsugyo no Tomosha, 2002.
[8] Mark R. Horton, “Standard for Interchange of USENET Messages,” RFC 850, June 1983. Retrieved 2021-05-05.
[9] Wikipedia, Fifth generation computer, 2021. Retrieved 2021-05-05.
[10] Public Telecommunications Act, July 1953. Retrieved 2021-05-05.
[11] Telecommunications Business Act, December 1984. Retrieved 2021-05-05.
[12] Wikipedia, DECUS, 2021, https://en.wikipedia.org/wiki/DECUS Retrieved 2021-05-05.
[13] The Constitution of Japan, November 1946. Retrieved 2021-05-05.
[14] ITU, “General principles for the lease of international (continental and intercontinental) private telecommunication circuits and networks,” Recommendation D.1, July 1991. Retrieved 2021-05-05.
[15] Advanced Telecommunication Research Institute International. Retrieved 2021-05-05.
[17] Wikipedia, Telebit, 2020. Retrieved 2021-05-05.
[18] Wikipedia, Open Computer Network, 2021. Retrieved 2021-05-05.
[19] Wikipedia, Asymmetric digital subscriber line, 2021. Retrieved 2021-05-05.
[20] Ina City Wired Broadcasting & Telephone Agricultural Cooperative. Retrieved 2021-05-05.
[21] Wikipedia, Digital subscriber line access multiplexer, 2021. Retrieved 2021-05-05.
[22] Wikipedia, Main distribution frame, 2020. Retrieved 2021-05-05.
[23] Wikipedia, AX.25, 2021. Retrieved 2021-05-05.
[24] ITmedia, Number of DSL subscribers decreased for the first time, September 12, 2006. Retrieved 2021-05-05.
[25] Wikipedia, Winny, 2021. Retrieved 2021-05-05.
[26] Wikipedia, WinMX, 2021. Retrieved 2021-05-05.
[27] Copyright Act, May 1970. Retrieved 2021-05-05.
[28] Agency for Cultural Affairs, “Outline of the law to partially revise the copyright law,” October 2010. Retrieved 2021-05-05.
[29] Wikipedia, Bitcoin, 2021, https://en.wikipedia.org/wiki/Bitcoin. Retrieved 2021-05-05.
[30] Review meeting on anti-piracy measures on the Internet, “Interim Summary (Draft) -Comprehensive Measures Against Pirated Sites on the Internet-,” September 2018. Retrieved 2021-05-05.
[31] Act on the Protection of Personal Information, May 2003. Retrieved 2021-05-05.
[32] Van Jacobson, “Content-Centric Networking,” IEEE Computer, Vol.46, Issue.1, January 2013.
[33] National Tax Collection Act, April 1959. Retrieved 2021-05-05.

[34] Eric Spengler,"Lessons From the Uber Case: "Employees" vs. "Independent Contractors"," May 2020. Retrieved 2021-05-05.
[35] Japan Federation of Hire-Taxi Associations, "Changes in the number of passengers and operating revenue," September 2020. Retrieved 2021-05-05.
[36] National Tax Agency of Japan," No.6501 Exemption from tax obligation," April 2020. Retrieved 2021-05-05.
[37] Labor Standards Act, April 1947. Retrieved 2021-05-05.
[38] Tohru Asami, "Thinking about Our Future from the Lost 20 Years of ICT in Japan," The Journal of IEICE, vol.103, no.12, 2020.