

# The decline of fax (and the rise of *keitai*, e-mail, and the Web) in the United States and Japan

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## INTRODUCTION

Faxing moved from a marginal to essential business communications technology in the early 1980s in Japan and the late 1980s in the United States. In the late 1990s in the United States and early 2000s in Japan, fax lost its primary role to e-mail, the worldwide web, and internet-capable cellphones (*keitai*) as economics, perceptions, and the environment shifted against faxing.

In both countries, faxing did not decline until its users, promoters, and observers decided better alternatives existed and changed to them. The acceptance of e-mail happened much later than e-mail promoters and other proponents of a digital communications future predicted. When the shift did finally occur, the ongoing evolution of faxing from standalone machines onto computers made the transition to e-mail fairly easy.

Faxing declined faster and differently in the United States than Japan, reflecting separate paths to similar goals of increased communication. In America, faxing did not decline until e-mail and the worldwide web could provide information and send messages and files as easily as faxing. The prior diffusion of PCs and internal corporate electronic networks gave e-mail a hospitable environment when it finally matured.

In Japan, acceptance of e-mail and the web had to await the development of electronics capable of handling *kanji*, *hiragana*, and *katakana* and business models that could package the new technology into profitable products that consumers wanted. Compared with America, the PC played a less important role and the cellphone a more important role in replacing faxing, reflecting its faster and greater penetration and spread in Japan.

## RISE OF FAXING

Japan proved a fertile ground for faxing for several reasons, reasons that also delayed the diffusion of e-mail. Japanese society has traditionally been

based on handwritten, not typed language. Its thousands of ideographic *kanji* did not lead themselves to typing, which was limited to newspapers and a few other areas. One *kanji* teletypewriter for newspaper printing had 192 keys with 13 shifts, demanding significant “drill and skill.”<sup>2</sup> As Yoshi Takayama, a NEC PC manager noted in 1993, “For many Japanese, using a keyboard is kind of like experiencing magic.”<sup>3</sup>

Fax proved ideal for *kanji*, exactly as Thomas Edison had predicted over a century ago when he developed a fax machine only to find a market lacking. A person could write a note or document and simply fax it.<sup>4</sup> Only basic office skills – dialing a number and inserting a piece of paper into a machine – were necessary while preserving traditional handwriting and calligraphy.

The Japanese system of addresses, a rare example where giving history priority is bad, also contributed to fax’s popularity. In Japan, an address does not indicate specific location but general location. One consequence is that a major function of the police is helping people find where they want to go. Another consequence was a major market for faxing maps. When I visited Japan in 1995, every appointment was preceded by a faxed map showing me where to go.

When communications compatibility issues had been solved with the G3 standard in 1980, the virtuous circle of rapid technological innovation, Japanese manufacturers’ battle for market share, decreasing prices, and increasing demand quickly turned fax machines into standard equipment for the office and many homes.

In comparison with Japan, diffusion of faxing was slower and, in the case of the home, nowhere near as great in America. Nonetheless, growing dissatisfaction with the rising cost of competing communication services such as the mail and telex, coupled with the network effects of a rapidly increasing fax community, created a fax boom in the late 1980s that made the fax machine an essential office tool. Nor was faxing confined to the world’s two largest economies. Worldwide, the installed base of fax machines and fax modems soared past 100 million by 1996, providing easy, near-universal and inexpensive service.

Faxing evolved significantly, becoming integrated with computers and adding new functions like fax broadcasting and fax-on-demand. Fax broadcasting allowed sending scores or thousands of faxes from one machine or a service. Fax-on-demand enabled people to receive information by fax – download in

contemporary parlance. Japanese firms were especially innovative in creating fax-on-demand services, such as snow forecasts at ski resorts and traffic updates.

In 1998, Fortune 500 firms still considered facsimile “the most reliable, easy to use, fast and most universal” way to get a response, with most firms faxing more than in 1997.<sup>5</sup> Nonetheless, sales of stand-alone fax machines peaked in 1997 in the United States and 2000 in Japan. Market saturation and decreasing demand were two causes. Equally important, basic fax machines were increasingly bundled into a multifunctional machine that also served as a printer, copier, and scanner for a home, small office, or even larger organizations. Similarly, sales of fax modems had dropped when modems became standard equipment on PCs.<sup>6</sup>

Actual faxing also declined. Reliable data are hard to find because facsimile’s integration into regular office operations made tracking its usage and number of fax-capable devices difficult. With the exception of Hong Kong for a few years,<sup>7</sup> fax calls used the same circuits as voice calls and thus could not be obviously distinguished. Starting in the mid-1990s, the rise of fax-over-internet and private data networks make estimating total fax use essentially impossible.

Until the mid-1990s, paper consumption was an excellent indicator of use. Analog machines primarily used electrolytic paper (which only had limited applications elsewhere). Most G3 fax machines from the mid-1980s into the 1990s used thermal paper, which understandably had few other uses so tracking its sales provided a direct proxy of use. The eagerly desired replacement of thermal by plain paper improved the quality of received documents but eliminated this indicator. The spread of computer-based faxing meant incoming messages arrived directly into computers, further complicating estimating usage. Nonetheless, by 2000 faxing began to decline steeply in America and more slowly in Japan.

## FROM FAX TO E-MAIL

In many ways, fax was its own worst enemy, laying the groundwork for e-mail and the web. Faxing accustomed people to easily send and receive messages in minutes, not hours or days. Computer-based faxing trained people to communicate from a computer and expect a quick reply. Fax-on-demand taught people to obtain information instantly and companies to

provide it.<sup>8</sup> Instead of hindering the transformation to the electronic office of the future as some digital advocates feared, faxing led the way while demanding less of users than early e-mail systems.

Ultimately, faxing was subsumed, albeit not fully, by the potent competitor of computer-to-computer communications, including data communications and electronic mail. This threat took two decades to emerge, bogged down by challenges of compatibility, reliability, capability, and usability far more daunting than those experienced by fax.

The slow development and diffusion of e-mail was certainly not due to a lack of effort. Worldwide, many firms and organizations invested considerable resources developing e-mail systems since the late 1970s, but encountered major resistance from users because of the many incompatible systems, difficulties in learning how to use them, and limited formatting and graphics.<sup>9</sup> By 1991, American firms could choose among 55 private e-mail networks, 15 electronic messaging services, and 80 e-mail software suppliers.<sup>10</sup> The problem of incompatibility was so bad that General Motors had to introduce a special interface, Diamond, to link its eight internal incompatible e-mail systems in 1987.<sup>11</sup>

If 1982 was the birth of internet e-mail with the creation of SMTP (discussed below), it matured like a human, not really reaching its potential until it became a teenager.<sup>12</sup> In the late 1990s, e-mail finally evolved sufficiently to become as easy and useful as faxing.<sup>13</sup> Or, as a Canadian business magazine warned, "Not being connected to Internet communications will represent as much of a business loss as not having a telephone or a fax machine."<sup>14</sup> Only then did this heralded technology of the digital future eclipse its analog upstart. Perhaps no clearer indication of the changing perceptions was the 1999 press announcement by E-Sync Networks boasting that its online fax service made "Sending a fax is as simple as creating an Internet e-mail message."<sup>15</sup>

The surprise was not that e-mail had overtaken facsimile but the long time needed to do so. E-mail's domination had been predicted and companies had staked their futures on it literally for decades. The arguments in favor of e-mail changed very little over time – the ability to edit and format documents, low cost, and worldwide access. What did change was the reduction of e-mail's very real negatives, the development of the worldwide web for information retrieval, and the continuing pressure for faster communications.<sup>16</sup>

E-mail's triumph stood on four foundations. Foremost was the creation of a communications protocol which extended compatibility throughout incompatible networks. ARPANET gave birth to the Internet in an inspired government-private enterprise partnership. In 1982, the Internet Engineering Task Force (IETF) introduced RFC 822, which resulted in the diffusion of the Simplified Mail Transport Protocol (SMTP), the first truly practical e-mail communications protocol to find universal acceptance.<sup>17</sup>

Second, the 1992 establishment of the Multimedia Internet Mail Extension (MIME) was a huge step toward e-mail's acceptance as a business tool. MIME enabled e-mail to convey files of different type, content and format from computer to computer, negating one of fax's biggest advantages, transmitting documents.<sup>18</sup> Software like Adobe Acrobat and improvements in scanners enabled easier conversion of written documents into electronic form, allowing their manipulation and storage by computer while eliminating the need to send a document by a standalone fax machine.<sup>19</sup>

Third, the changing office environment greatly benefitted e-mail. From 1991 to 2004, PCs worldwide grew from 130 million to 775 million.<sup>20</sup> Many of those machines were connected through modems and networks, and the number of e-mail accounts exploded in the late 1990s, reaching an order of magnitude greater than fax machines.<sup>21</sup>

E-mail further benefitted from a generation of users trained in Word and other software who now found it easy to operate e-mail systems based on the GUI (graphical user interface) principle of Apple and Windows. Bulletin boards and listservs offered even easier distribution of messages than fax broadcasting and proved more effective in collaborating and exchanging ideas and information.

Fourth, the Worldwide Web provided the first serious competition to Fax-on-demand. What the Web could offer that Fax-on-demand lacked was the search engine, one of the most powerful tools ever for finding information. The number of websites grew from 19,000 in 1995 to 1 million in 1997, 20 million in 2000, and 100 million in 2006.<sup>22</sup> And search engines could find desired data in them.

The Web also provided one of faxing's key attributes, imagery. Years before the interactivity of Web 2.0, static maps, available as downloads or sent as attachments, provided an increasingly easy alternative to faxing maps. The "killer app" was the interactive map, providing the viewer with increased

flexibility.

Accessing a webpage increasingly proved more attractive than fax-on-demand for providers and customers. Nowhere was this demonstrated better and earlier than Morgan Stanley. The international banking firm in the early 1990s had a team working nightly in New York City cutting, pasting and then faxing a hundred-page compendium of updated financial data to brokers and traders. By late 1995, automatic database extraction software constantly updated the information on a webpage.<sup>23</sup>

Uncertainty about its legal status delayed the acceptance of e-mail in both Japan and the United States. The law favors existing technologies because their strengths and weaknesses are known and embedded in the daily operations of their users. In the United States, the Electronic Signatures Act of 2000 gave electronic contracts the same weight as those executed on paper, though acceptance trailed by several years. Not until April 2005 did Japan pass the "e-documentation laws" that provided legal standing for electronic documents.<sup>24</sup> In both countries, practical acceptance lagged legal authorization as organizations and individuals proved reluctant to switch to the new system.

## AMERICAN E-MAIL

Compared to Japan, American organizations and individuals switched from faxing and adopted e-mail more quickly. The major difference was using the personal computer to access the Web and internet.

PC growth was far quicker in the US than Japan. One reason for the rapid spread was IBM's decision to promote non-proprietary standards for its PC, which created a competitive and rapidly expanding market. This was not due to a munificent decision on Big Blue's part but rather an effort to avoid being charged with monopolistic practices. The result was an explosive growth of PCs in office and home as many firms entered the market with hardware and software. Diffusion of PCs meant people already had the equipment in their office, business, or home when they decided to go online. Decreasing telecommunication costs lowered the financial barriers to entry for e-mail. Compared with Japan, many telephone line subscribers paid a fixed fee

While neither the internet nor the web were total American developments,

the United States did dominate both, which is why the United States is the only country without a country code at the end of an e-mail address.. Of over 430 million Internet host computers in January 1999, the US had 71% of them, compared with 4% for Japan.<sup>25</sup>

## JAPANESE E-MAIL

The Japanese path to the Web and internet differed from the American trajectory due to several factors, including the slower diffusion of PCs, large word processor and homefax markets, and the use of cellphones to access the net

Several factors slowed the growth of the Japanese PC market into the 1990s, including a deliberate and massive incompatibility problem. Manufacturers created "locked in" software and hardware, ensuring that, for example, only NEC software and hardware would work with a NEC machine. Outside software developers had to create manufacturer-specific software. Manufacturers also owned or financed many retail stores and built word processors, a market they did not wish to cannibalize by reducing the price difference between them and PCs. The result was high costs and incompatible equipment, neither designed to attract consumers, and a low rate of PC sales compared with the United States.<sup>26</sup> Not until Microsoft introduced a Japanese version of Windows 95 did the PC market truly expand.<sup>27</sup>

In Japan, acceptance of e-mail and the web had to await the development of electronics capable of handling *kanji*, *hiragana*, and *katakana* and business models that could package the new technology into profitable products that consumers wanted. The key differentiating technology that enabled successful Japanese computerization was automatic kana-to-kanji translation. PCs had to be more capable than their American counterparts, not just in computing capabilities to quickly do the translations, but also high-resolution printing and displays to display the intricate *kanji* characters. The printhead for the JW-10 word processor, for example, had 24 dots, compared with 9 dots for an English language printhead.

Less visible but a major reason for the slow penetration of the PC in Japan was the word processor, which pioneered automatic katakana-to-kanji translation. For the first time, typing Japanese without special training became feasible.

Professor Toshihiko Kurihara began Japanese research on automatic katakana-to-kanji translation in 1967 and Toshiba began its inhouse research four years later. In September, 1978, Toshiba introduced the 180 kilogram JW-10 word processor for 6.3 million yen.<sup>28</sup> The word processor market, like the fax market, grew rapidly as Japanese manufacturers fought for market share by introducing new equipment with more features and lower prices. By 1983, prices had dropped to 500,000 yen and under 100,000 yen by 1985. Sales soared to reach 2.7 million machines in 1989 and 27% of Japanese homes, and over 30 million had been sold by 2000.<sup>29</sup>

Word processors peaked in households at 50% in 1997 before slowly falling until 2000 (45%) and then dropping sharply (27% in 2003).<sup>30</sup> Because the PC manufacturers also produced word processors, these firms had an interest in maintaining a significant price differential between their two types of products.

Home fax was a major difference between Japan and the US. Penetration of fax machines into Japanese homes began around 1990, accelerated after 1993, reached 15% of homes in 1995 and crossed the 50% mark in 2002.<sup>31</sup> In contrast, home fax machines never became a big American market despite several efforts to expand beyond the SOHO (small office home office) niche.

In Japan, homefax had several attractions. The narrow price differential between a basic phone and combined fax-phones was one reason for the wide spread of home fax. For only a few hundred yen more, customers could acquire a far more versatile home machine, one that increasingly served as an answering machine too. In terms of space, a homefax did not have a big footprint, an important consideration for small Japanese apartments. Homefax also enabled word processor owners to easily transmit their documents to anyone else who had a fax machine, significantly increasing the utility of a home word processor .

Table 1. Household penetration rate (end of year in percent)

	fax	word processor	PCs	internet-compatible cellphone
1996	21	42	22	--
1997	26	50	29	--
1998	32	47	33	--
1999	34	44	38	9

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2000	40	45	51	27
2001	41	34	58	45
2002	51	32	72	48
2003	54	27	78	57

Source: Ministry of Public Management, Home Affairs, Posts and Telecommunications, Information and Communications in Japan. Building a Ubiquitous Network Society That Spreads Throughout the World. White Paper 2004 (Tokyo: MPMHAPT, 2004), 49.

The most visible difference was the internet-capable cellphone. By 1999, the Japanese handset market was the world's most competitive market with features, functions, and uses unequalled elsewhere.<sup>32</sup> The 1999 launch of DoCoMo's i-mode, KDDI's Ezweb, and J-phone's J-Sky extended that competition to the internet. For far, far less than the cost of a PC and telephone line, subscribers could access the internet. Internet-compatible cellphones proved very popular, jumping from 9% of Japanese households in 1999 to 27% in 2000, 45% in 2001, and 57% in 2003.<sup>33</sup> The demand for browsing services in i-mode turned DoCoMo into the world's largest ISP provider "almost overnight."<sup>34</sup>

By 2004, if not since 1999, Japan had the world's highest absolute number and percentage of mobile net users with more *keitai* than PCs linked to the net.<sup>35</sup> And e-mail was the top reason for 74% of consumers to use the net, according to the 2003 Ministry of Communications Communications Usage Trend Survey. The rapid Japanese embrace of mobile net applications, according to an ITU study, was due primarily to "low PC and internet penetration," long commutes on public transit where *keitai* became an essential form of entertainment and quiet texted communication, and an eager market of young users.<sup>36</sup>

In contrast, cell phone usage grew more slowly in the US and mobile internet usage even more so for several reasons, including incompatible competing equipment and high costs. US cellphones were also less capable: In 2004, 90% of Japan's cellphones had internet capability compared with 12% of American cellphones in 2004.<sup>37</sup>

Use of internet by Japanese businesses depended on size. The gap between corporations and smaller businesses and homes was particularly impressive as Table 2 shows. In 1999, 78% of all large businesses (over 100 people)

used the internet compared with 93% of all firms over 1000 people. By 2001, that gap had essentially disappeared (95% and 99% respectively).<sup>38</sup>

Table 2. Internet usage (%)

	corporate	business	home
1995	11.7		
1996	50.5	5.8	3.3
1997	68.2	12.3	6.4
1998	80.0	19.2	11.0
1999	78/93*		
2000	89/97*		

\* companies over 100 people/corporations over 1000 people  
 Sources: 1995-98, "FY 1998 Communications Usage Trend Survey" in Ministry of Posts and Telecommunications, Communications in Japan 1999 I-Introduction-1. Widespread use of the Internet; 1999-2000 corporate, MPHPT 2003 "Communications Usage Trend Survey" in Ministry of Public Management, Home Affairs, Posts and Telecommunications, Information and Communications in Japan. Building a Ubiquitous Network Society That Spreads Throughout the World. White Paper 2004 (Tokyo: MPMHAPT, 2004).

## CONCLUSION

The fax diffused more rapidly in Japan than the United States while e-mail and the web diffused more rapidly in the United States than Japan. Technical, economic, and social factors shaped the different trajectories of these countries as they converged on the same technologies. Interestingly, both PCs in Japan and cellphones in America experienced similar slow diffusion while PCs in America and cellphones in Japan experienced rapid diffusion.

E-mail software took a long time to mature sufficiently for large-scale acceptance. Once developed, it spread rapidly in the US thanks to an existing infrastructure of PCs and internal corporate networks and a culture of typing. Decreasing telecommunication charges facilitated the diffusion of e-mail in offices and homes.

E-mail's slower diffusion in Japan had to wait for an infrastructure to develop. The major technical difference with the United States, based on J fax R sota

the ideographic Japanese language, was the creation of specialized katakana-to-kanji translators, which made the widespread diffusion of typing possible. The word processor, a single-function computer, and not the PC played a vital role in creating a typing culture. The word processor 's profitability slowed diffusion of the PC as did the inability of Japanese manufacturers to agree on PC standards. One result of this slower diffusion was the rapid development and acceptance of cellphones to access the internet,

For e-mail, the critical point was when it became easier to use and less expensive than faxing, an accomplishment that took far longer than its advocates expected. Perhaps the best indicator of this transition was when criminals switched their hunt for victims from fax to e-mail.

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1. Texas A&M University/Tokyo Institute of Technology; j-coopersmith@tamu.edu
  2. Tautomu Kawada, Shin-ya Amano, Ken-ichi Mori, and Koji Kodama, "Japanese Word Processor JW-10," Proceedings of Compcom (September 1979), 238.
  3. Brenton R. Schlender, Emily Thornton, and Cindy Kano, "U.S. P Cs Invade Japan," Fortune July 12, 1993  
[money.cnn.com/magazines/fortune/fortune\\_archive/1993/07/12/78059/index.htm](http://money.cnn.com/magazines/fortune/fortune_archive/1993/07/12/78059/index.htm)  
(downloaded January 14, 2009).
  4. Thomas Edison to John Clark Van Duzer, December 6, 1868, Papers of Thomas A. Edison The Making of an Inventor, February 1847-June 1873 (Baltimore: Johns Hopkins University Press, 1989), v. 1., 90-95.
  5. Scott Cullen, "The year in fax," Office World News 26,12 (December 1998), 1.
  6. "FY2001 Mid-Term Demand Forecast of Telecommunications Equipment", Communications and Information Network Association of Japan, Yearbook

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2002 (Tokyo: CIAJ, 2002) 14; Eric A. Taub, "Ease of Paperless E-Mail Sidelines the Forlorn Fax," New York Times March 13, 2003, E7.

7. The phone monopoly established separate fax and voice lines in 1981 (D. C. A. Connolly, "Development of Data and Fax Communications in Hong Kong," IEEE Region 10 Conference on Computer and Communication Systems (Hong Kong: IEEE, September 1990), 793-96).

8. Faxing also helped establish the concept of people receiving free equipment or services in exchange for information about them. Like many ideas, it was ahead of its time: HomeFax failed to find the venture capital needed to create an "advertiser-supported home fax ntwk." (Esther Dyson, "Who pays for data," Forbes February 3, 1992, 96).

9. Peter Vervest, Electronic Mail and Message Handling (Westport, Conn.: Quorum Books, 1985), 69; L. Brett Glass, "Fax Facts," Byte February 1991, 301-08.

10. "Electronic Messaging -- A \$10 Billion Franchise Up for Grabs," EMMS June 17, 1991, 3. In January 1994, the editors of Electronic Mail and Micro Systems newsletter listed six e-mail addresses and one fax number as ways of contacting them ("Ballot," EMMS January 15, 1994, 12).

11. "WU Easylink Service Now Available," PR Newswire June 29, 1987. Lexis

12. Marshall T. Rose and David Strom, Internet Messaging. From the Desktop to the Enterprise (Englewood Cliffs, New Jersey: Prentice Hall, 1998), 290.

13. For a history, see Janet Abbate, Inventing the Internet (Cambridge, Ma: MIT Press, 1999). As Michael Kinsley noted, just as 1989-90 marked the transition from "what is your fax number" to annoyance if the responder lacked a fax machine, so do would 1996-97 mark a similar transition for e-mail (Michael Kinsley, "The morality and metaphysics of e-mail," Forbes December 2, 1996, S113).

14. Dale Burger, "Report warns businesses to connect with Internet or face drop in profits," Computing Canada January 4, 1995, 33.

15. "Ford Motor Company Chooses E-Sync Networks for Global On-Line Fax

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Services," Business Wire September 20, 1999  
<http://www.encyclopedia.com/doc/1G1-55785969.html> (downloaded December 12, 2006).

16. E.g., Alan Cane, "Wide choice of electronic mail systems," Financial Times April 13, 1982, Internet fax, 19; Dan Sheridan, "Electronic mail challenges fax market," Crain's Chicago Business May 8, 1989, T8.

17. John Rhoton, X.400 and SMTP. Battle of the E-mail Protocols (Boston: Digital Press, 1997), 88, 97.

18. Sanjiv P. Patel, Grant Henderson, and Nicolas D. Georganas, "The multimedia fax-MIME gateway," Multimedia 1,4 (Winter 1994), 64-70; Geoffrey Wheelwright, "New front opens in the net versus fax battle: Internet Faxing," Financial Times March 21, 2001, 2.

19. Jim Carlton, "Down to Business," Wall Street Journal June 19, 1995, R32.

20. ITU and TeleGeography, Inc., Direction of Traffic. International Telephone Traffic, 1983-1992 (Geneva: ITU, 1994), 3; ATT, "Rate changes through the years," 1999. ATT Archives, Box 04 11 01; ITU, "Key Global Telecom Indicators for the World Telecommunication Service Sector," 2006 [http://www.itu.int/ITU-D/ict/statistics/at\\_glance/KeyTelecom99.html](http://www.itu.int/ITU-D/ict/statistics/at_glance/KeyTelecom99.html) (accessed June 12, 2006).

21. ITU, World Telecommunication Development Report (Geneva: ITU, 1994), 43.

22. Netcraft, "November 2006 Web Server Survey," [news.netcraft.com/archives/2006/11/01/november\\_2006\\_web\\_server\\_survey.html](http://news.netcraft.com/archives/2006/11/01/november_2006_web_server_survey.html) (downloaded October 15, 2007).

23. Alison L. Sprout, "The Internet Inside Your Company," Fortune November 27, 1995, 168; "Economists Switch To Efficient E-Mail, Shelving Costly Faxes," Wall Street Journal June 8, 1999, B4.

24. "Laws concerning the usage of information technology for saving the documentations by private businesses" and the "Laws to managing the implementation of the Laws concerning the usage of information technology

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for saving the documentations by private businesses."

25. Ministry of Posts and Telecommunications, Communications in Japan 1999 (Tokyo: MPT, 1999), I-Intro-4 WEB Citation

26. Brenton R. Schlender, Emily Thornton, and Cindy Kano, "U.S. P Cs Invade Japan," Fortune July 12, 1993  
money.cnn.com/magazines/fortune/fortune\_archive/1993/07/12/78059/index.htm (downloaded January 14, 2009).

27. Develop

28. IEEE Global History Network, "Japanese word processor text,"  
[http://www.ieeeahn.org/wiki/index.php/Japanese\\_word\\_processor\\_text](http://www.ieeeahn.org/wiki/index.php/Japanese_word_processor_text)  
(downloaded February 11).

29. IPSJ Computer Museum, "Japanese Word Processors,"  
<http://museum.ipsj.or.jp/en/computer/word/history.html>.

30. Ministry of Public Management, Home Affairs, Posts and Telecommunications, Information and Communications in Japan. Building a Ubiquitous Network Society That Spreads Throughout the World. White Paper 2004 (Tokyo: MPMHAPT, 2004), 49.

31. Shuzo Sasaki, "Facsimile's role in the creation of a multimedia era," Japan 21<sup>st</sup> 41,11 (November 1996), 32; Ministry of Public Management, Home Affairs, Posts and Telecommunications, Information and Communications in Japan. Building a Ubiquitous Network Society That Spreads Throughout the World. White Paper 2004 (Tokyo: MPMHAPT, 2004), 49.

32. Sven Lindmark, Erik Bohlin, and Erik Andersson, "Japan's mobile internet success story – facts, myths, lessons and implications," Info: the Journal of Policy, Regulation and Strategy for Telecommunications 2004 (6,6), 350-52.

33. Ministry of Public Management, Home Affairs, Posts and Telecommunications, Information and Communications in Japan. Building a Ubiquitous Network Society That Spreads Throughout the World. White Paper 2004 (Tokyo: MPMHAPT, 2004), 49.

34. Lara Srivastava, "Ubiquitous Network Societies: The Case of Japan" (Geneva: International Telecommunications Union, April 2005).

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Document UNS/07, 19.

35. Lara Srivastava, "Ubiquitous Network Societies: The Case of Japan" (Geneva: International Telecommunications Union, April 2005).  
Document UNS/07, 19.

36. Lara Srivastava, "Ubiquitous Network Societies: The Case of Japan" (Geneva: International Telecommunications Union, April 2005).  
Document UNS/07, 19.

37. Lara Srivastava, "Ubiquitous Network Societies: The Case of Japan" (Geneva: International Telecommunications Union, April 2005).  
Document UNS/07, 20.

38. Ministry of Public Management, Home Affairs, Posts and Telecommunications, Information and Communications in Japan. Building a Ubiquitous Network Society That Spreads Throughout the World. White Paper 2004 (Tokyo: MPMHAPT, 2004), 51.