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History of the Software Industry

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Watershed of the Software Industry

In 1955, the world's first software company was formed in the United States. Now, more than half a century later the software market has entered a period of drastic change. Many information processing functions found in packaged software have been transferred to the Web, and the use of open source software (OSS) has become widespread. There are also strong signs that "Software as a Service" (SaaS) will assume a greater prominence. These developments go beyond a mere discussion of whether to charge fees or to choose between packaged software or contracted development, or to use open source or proprietary software; they have shaken the software industry to its very foundation.

Will the software industry continue to develop as a high-tech industry, or will creative destruction occur and a new industry grow from the ashes? Perhaps the industry will disappear altogether and become just another business service like embedded software?

Tim O'Reilly describes three long-term trends in the evolution of software: (1) commoditization, (2) network collaboration, and (3) SaaS.

He points out that the emphasis in software has changed from "product" to "process":

We're used to thinking of software as an artifact rather than a process. ... But it is in the area of software that is not commoditized, the "glue" that ties together components, the scripts for managing data and machines, and all the areas that need frequent change or rapid prototyping, that dynamic languages shine. Sites like Google, Amazon, or eBay—especially those reflecting the dynamic of user participation—are not just products, they are processes. ...

Now, in an ironic circle, applications once more have people hidden inside them. Take a copy of Microsoft Word and a compatible computer, and it will still run ten years from now. But without the constant crawls to keep the search engine fresh, the constant product updates at an Amazon or eBay, the administrators who keep it all running, the editors and designers who integrate vendor- and user-supplied content into the interface, and in the case of some sites, even the warehouse staff who deliver the products,

the Internet-era application no longer performs its function. ... Of course, there have always been enterprise software businesses with this characteristic. But only now have they become the dominant paradigm for new computer-related businesses.[1]

The software industry has seen the development of unbundling, modularity, openness, and commoditization, but as websites and SaaS have become more important the evolution of the industry has begun to change direction. O'Reilly's predictions may be not be positive for the Japanese software industry, which has excelled at creating custom software for enterprises rather than packaged software, and has been better at integration than modularization.

This paper begins by recognizing that the software industry is approaching a historical watershed, and then discusses the history of the Japanese and U.S. industries from two perspectives: relationships between companies and the government, and market change. Finally, the paper examines strategies to further develop the Japanese software industry.

U.S. Software Industry and the Department of Defense

If a software company is defined as "an

independent profit-making enterprise that sets out to develop computer programs," then we can consider the world's first software company to be the Computer Usage Corporation (CUC), founded in the United States in 1955 by two former IBM workers, Elmer C. Kubie and John W. Sheldon. The company made its first public stock offering in 1960 and by 1967 had more than 700 employees. CUC got into financial trouble toward the end of the 1970s and it went bankrupt in 1986. In 1956, CEIR and the non-profit System Development Corporation (SDC), which spun off from the RAND Corporation, were established. In 1959, seven former UNIVAC programmers formed Applied Data Research (ADR). Two engineers who had experience with computers in the aviation industry formed Computer Sciences Corporation (CSC) in the same year. A decade later CSC was the largest company in the industry.

A great many software companies were formed towards the end of the 1960s, large amounts of funding weren't needed to start a venture business in the United States at that time. The number of companies increased rapidly to nearly 2,000, but only a part of total software investment, estimated at several billions of dollars a year, was allocated to market transactions. Non-profits like SDC and universities were the top players, followed by computer manufacturers that bundled software with their hardware.

Independent software companies were not leaders in terms of market transactions.

The turning point came in 1969 when IBM lost an antitrust case to the Department of Justice and announced it would un-bundle its hardware and software. This gave impetus to the trend of charging for software, which rapidly grew into an independent industry. The Department of Defense played a major role in this. At the time, government agencies in the United States, including the Department of Defense, accounted for 85% of software demand. Software was in extremely high demand for military purposes, even compared to semiconductors and other dual-use technologies (all-purpose technology for both military and industrial applications). The Department of Defense worked with universities such as the Massachusetts Institute of Technology to develop advanced software. Strong cooperation between industry, academia and government was able to concentrate on both the creating advanced software technologies and developing a more independent software industry. Their efforts produced results that included the Semi-Automatic Ground Environment (SAGE) system and various time-sharing systems as well as the COBOL and BASIC programming languages.

When COBOL was developed in 1960, the U.S. government in 1961 urged computer

companies to commercialize COBOL-based products and promised favorable procurement practices for those products. COBOL was used widely as the standard language for administrative processing. The U.S. government played a major role in not only technology development but also the spread and usage of applications. The U.S. software industry still enjoys large transactions with governmental clients, including the Department of Defense, which continues to influence decisions regarding de facto standards and the exploration of new application fields.

Japanese Software and the Nippon Telegraph and Telephone Public Corporation

Eleven years after the first software company was established in the United States, in August 1966 Shigeru Okubo founded Computer Applications (currently Computer Applications Corporation, CAC) as the first independent software company in Japan. Two months later, in October, the Japan Software Company was established under national policy with joint capital from Hitachi, Fujitsu, NEC and the Industrial Bank of Japan. In 1969, many computer manufacturer-affiliated software companies were formed in addition to independent companies such as Nippon EDP and Nippon Computer System.

At that time, government-related sales accounted for less than 60% of the turnover of the top eight independent software companies. Most of these companies emerged out of the first large project to develop high performance electronic computers, carried out from 1966 to 1971. The ratio of government demand, excluding that related to this project, was only about 25%, an obvious difference from the United States.

The Nippon Telegraph and Telephone Public Corporation (NTT) started the "DIPS" (Dendenkosha Information Processing System) computer project in 1968, which served as a major client of these new Japanese software companies. Instead of placing orders with independent software companies, programs were ordered primarily by NEC, Fujitsu, and Hitachi, which worked jointly on DIPS research and development. The NTT project helped improve both hardware and software technology. Though the technological details have not been disclosed since these were custom-made programs, Mr. Yoshiro Nakamura, formerly a Director at Fujitsu and who set-up Fujitsu's software business, stated "there was no recognizable difference between file management technology employed in Japan and the United States, which became the archetype for our database; it was on virtually the same level as the United States."

Computer manufacturers have managed to enhance software development capabilities, but software companies created under national policy have ended in failure. The government provided three billion yen in subsidies to Japan Software Company over six years. After the subsidy program was complete the company was expected to sell its software and become profitable as an independent operation. However, the company dissolved in December 1972 after serious labor-management disputes and harsh financial difficulties arose after project completion. Initial policies in Japan, unlike in the United States, aimed more at enhancing computer manufacturer's technological capabilities instead of cultivating an independent software industry.

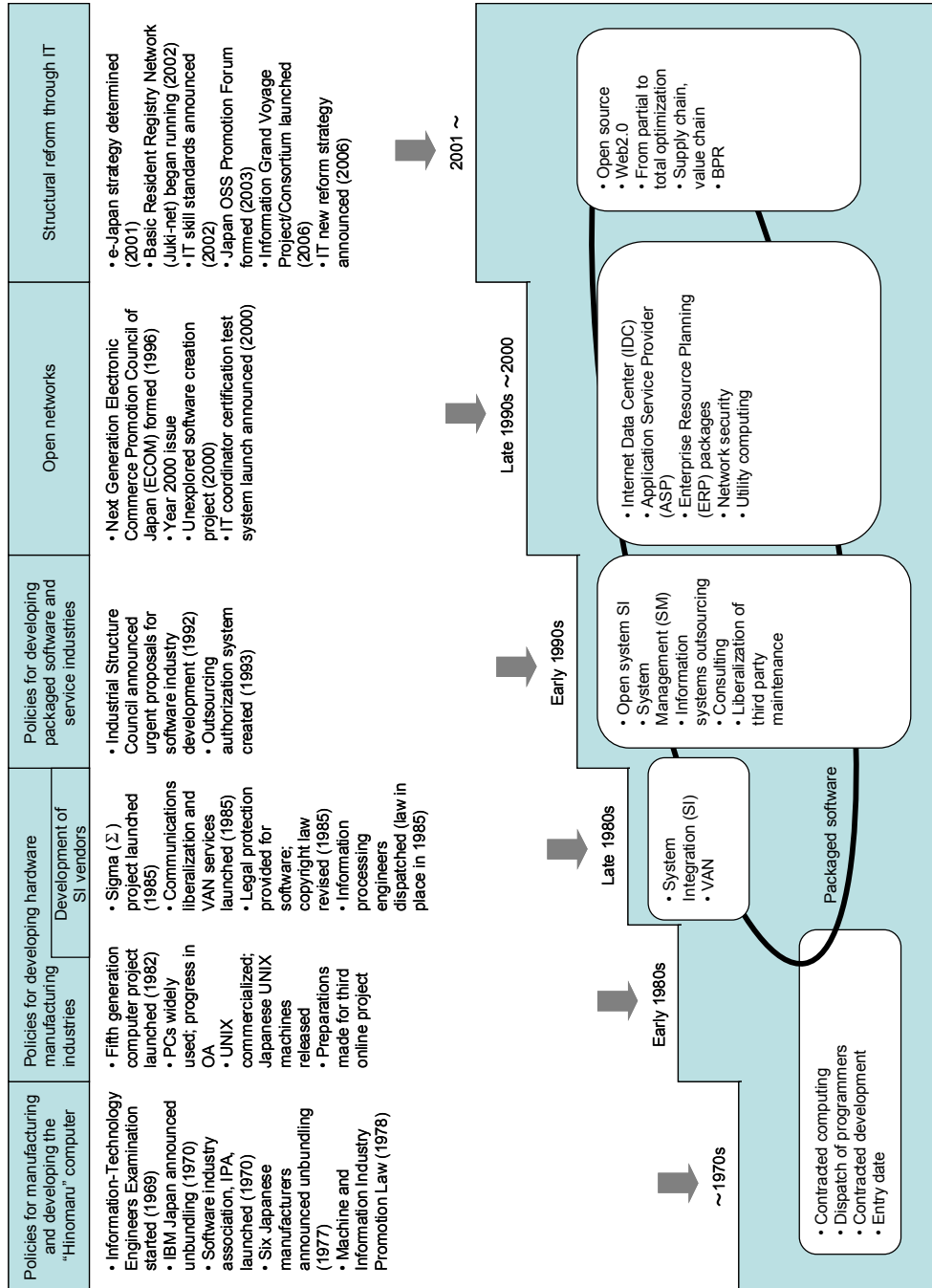


Figure 1. Japanese Software Industry Policy Changes (Source: Johhoka Hakusho (Information White Paper) 2006, p.34; drafted by the author and compiled by JIPDEC, the Japan Information Processing Development Corporation)

Software Industry Policies of the Ministry of International Trade and Industry

The Ministry of International Trade and Industry (MITI; now Ministry of Economy, Trade and Industry, or METI) included the independent software industry in its policies for the first time in 1970. In July 1970, MITI's electronic industry section was divided into an electronic policy section, responsible for the computer industry, and an information processing promotion section responsible for the software industry. Also, the Law on Promotion of Information Processing (IPA Law) was enacted on May 22, 1970, and the Information-Technology Promotion Agency (IPA) was formed in October 1970.

The most important challenge at that time was to catch up with IBM. When the Law for Temporary Measures for the Promotion of Specified Electronic and Machine Industries (Machine Industry Promotion Law) was enacted in 1971, six companies were grouped into three: Fujitsu and Hitachi, NEC and Toshiba, and Oki Electric Industry and Mitsubishi Electric. About 65 billion yen of financial support was provided to these three groups over five years to encourage the early development of domestic computers. When the development program was complete in 1974, the government moved rapidly to liberalize financing of the industry and trading with foreign

computer companies. Liberalization, including software related funding was completed by 1976.

In November 1977, eight years behind IBM, six Japanese companies announced the unbundling of their hardware and software. In 1978, the Law for Temporary Measures for the Promotion of the Advancement of the Machine and Information Industries (Machine and Information Industry Promotion Temporary Measures Law) was enacted, and in June 1978, the Software Distribution Promotion Center was established to encourage charging for and distributing all-purpose software. However, it proved difficult to push the distribution of all-purpose software in Japan. Most mainframe package software was imported, the only domestic product to have commercial success was A-AUTO, automatic operation management software developed by Fujifilm for internal use and later commercialized by Software AG (currently Beacon IT). Manufacturers normally subcontract software program development, very few companies have been involved in importing packaged software, and internal development and commercialization is even less common. After the economic bubble burst in 1992 a sense of crisis quickly developed in the Japanese software industry. In December 1992, the MITI subcommittee on basic policy directions of the Information Industry Sectional Meeting of the

Industrial Structure Council, chaired by Kenichi Imai, presented an "Urgent Proposal: The New Age of Software," emphasizing the necessity for immediate change in the information service industry and traditional hardware policies. The proposal also suggested stricter policies for developing packaged software and system integration (SI) services, to avoid a situation where software is traded on the basis of engineer labor in man-months (See Figure 1). Fifteen years have passed and very little progress has been made in changing the structural problems of the industry.

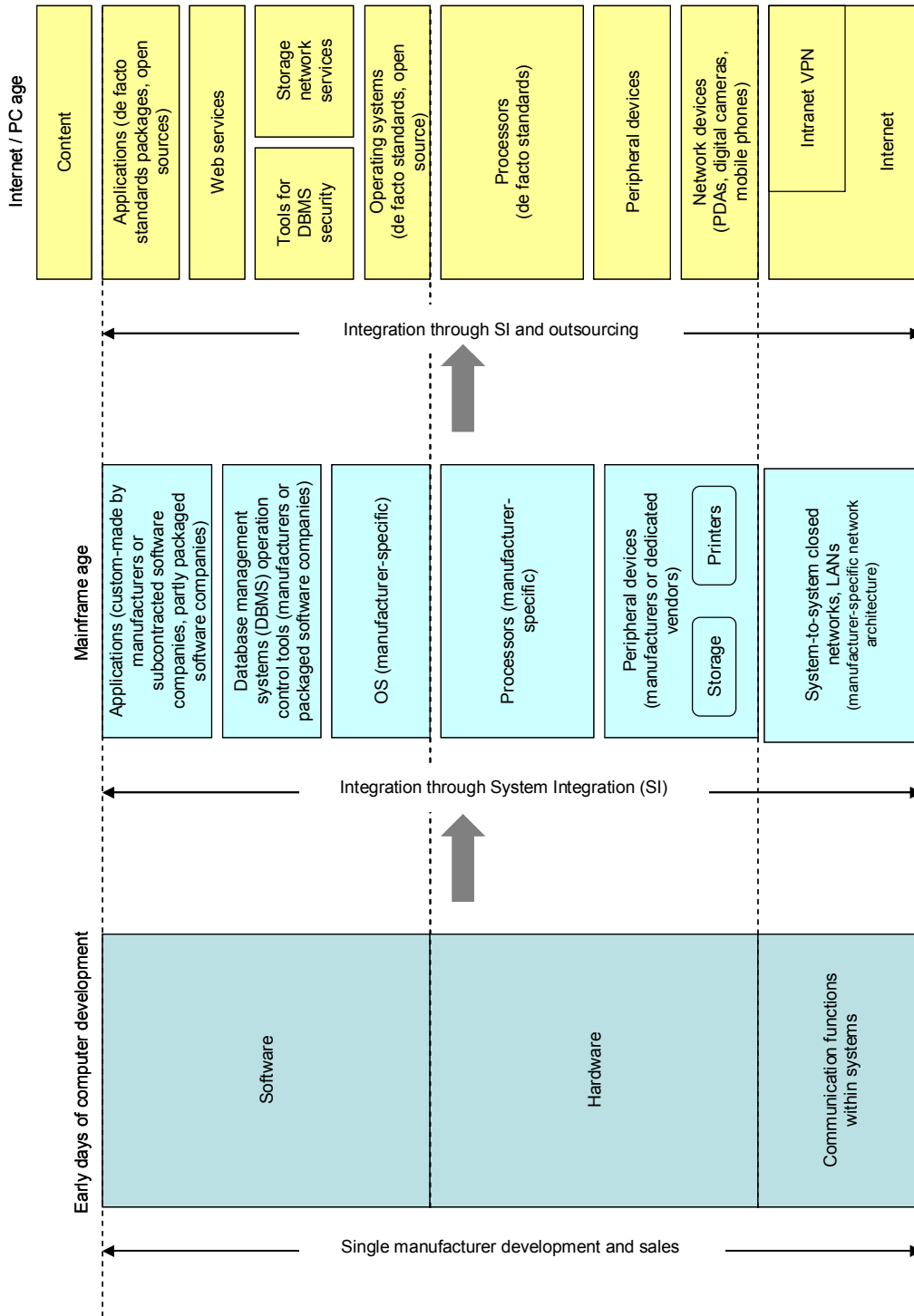


Figure 2: IT Market Modularization
 (Source: Johoka Hakusho 2006, p. 28; created by the author)

Market Change and Japan's Strategy

Modular programming and computer design has developed consistently in the software market over the past half century. Carliss Baldwin pointed out that IBM's System/360, released in 1964, incorporated the first truly modular computer design. Its new operating system (OS), the first of its kind, became the defining element of the new mainframe computer (see Figure 2). Modular interfaces at that time could only be shared inter-departmentally. However, as we moved further into the PC and Internet age, specialist companies began to take over the different modules –Intel for processors, Microsoft for OS, and Oracle for database management systems– and the IT industry itself became modularized. [2]

Japanese companies were not the only ones that could not adapt themselves to this change. As mainframes became the focus, the United States East Coast, where IBM and Digital Equipment Corporation (DEC) were located, became the main generator of new technology and IT business. As personal computers and then the Internet became popular, leadership moved to the West Coast, particularly to Silicon Valley. IBM had to carry out large-scale restructuring in the early 1990s, DEC was bought by Compaq. At the same time Japanese computer manufacturers became increasingly

dependent on mainframes, reflecting their policy focus of catching up with IBM, and their business went into terminal decline by the 1990s. Though many companies specialize in creating particular modules, computer systems are designed with interfaces that can be shared among companies. These computers have what are called "open systems," which make it impossible for specific manufacturers to fence in users. IBM lost its lead when the market began to focus on open systems, but it came back later with outsourcing services. IBM also shifted its focus from internal to inter-company coordination. It embraced the open source community becoming a pioneer in open source software

development though a one-billion-dollar investment in Linux and translating over 100 software patents to open source licenses.

Despite the fact that Japanese companies have had superior software technology for quite some time and even today create international programming languages such as Ruby, developed by Mr. Yukihiro Matsumoto, they don't seem to be able to create new businesses around these developments, and they continue to exhaust their own engineers. They should follow IBM's lead and create open source elements from their existing technology patents to reduce maintenance costs and keep pace with technological change. Open source community feedback has become a precious resource for technology

development.

We should also take another look O'Reilly's predictions. It is important to examine ways to create new business opportunities by developing customized technologies for enterprises, something that has always been a strong point of Japanese companies. The Japanese manufacturing industry has excelled in innovating "processes" rather than "products". A more advantageous strategy for the Japanese software industry would be to focus on creating better software services and to take greater initiative in promoting the change from products to processes.

[1]Summary and excerpts from The Open Source Paradigm Shift, Tim O'Reilly, 2004. (<http://tim.oreilly.com/lpt/a/4868>)

[2]Modularity references: Modularity: Essence of the New Industrial Architecture, Masahiko Aoki/Haruhiko Ando. Toyo Keizai Inc., 2002; Design Rules: The Power of Modularity, Carliss Baldwin and Kim Clark, translated by Haruhiko Ando. Toyo Keizai Inc., 2004; Evolution of Product Architecture, Tomoatsu Shibata, Kiminori Genba, and Fumio Kodama. Hakuto-Shobo Publishing Company, 2002.