Government Policy, Continental Collaboration and the Diffusion of Open Source Software in China, Japan, and South Korea

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Abstract:
The scale of development and deployment of open source software (OSS) in the three Northeast Asian countries–China, Japan, and South Korea–is large enough to be noticed at the global level. OSS has redefined the dynamics of software markets in the three countries and has brought significant structural changes in their software industries. Governments have played a pivotal role in the development of OSS industry in the region. Governments in the three countries have also created impetus for continental collaborations in OSS projects. This paper examines the roles and contributions of governments to the OSS initiative in the three countries in terms of a number of technology visions and goals.
Keywords: OSS, Northeast Asia, continental collaboration, government roles, China

Article:

INTRODUCTION

The scale of development and deployment of open source software (OSS)[1] in the three Northeast Asian countries–China, Japan, and South Korea (CJK)–is large enough to be noticed at the global level. In the second half of 2003 alone, Linux (one form of OSS) sales in the Chinese PC market crossed 800,000 copies.[2] In November 2003, Sun announced a multi-year deal to sell 200 million copies of Linux-based Java Desktop System to the Chinese government.[3] Likewise, by the mid-2004, Linux use in the server market accounted for about 10% in South Korea and 12% in the Japan (SinoCast China Business Daily News, 2004). Indeed, analysts argue that OSS has redefined the dynamics of software markets in the three countries (Software Industry Profile, 2005a,b,c) and has brought significant structural changes in their software industries (Kshetri, 2005).

Political and economic forces are driving the three Asian nations' inclination towards OSS (Himmelsbach, 2004). What is more unique in the Northeast Asian OSS industry is the rapidly increasing impetus for continental collaborations. The three traditionally rival economies in the region–China, Japan, and South Korea–are collaborating on a wide range of OSS projects. What is even more important is the fact that governments in the three countries are actively promoting such collaborations. A superimposition of the hyperbolic global diffusion of OSS onto the CJK position in the global economy indicates a far reaching impact of the North Asian OSS development on the global IT industry.

Clearly, there are under-explored issues in the regionalization of East Asia. The goals of this paper are twofold: (1) to examine the roles of governments in the development of OSS industry in Northeast Asia; (2) to explain the emergence of collaboration among the three economies in OSS projects. The remainder of the paper is structured as follows: The next section briefly examines the OSS industry in the three Northeast Asian countries. Next, we review relevant literature on governmental roles in the diffusion of a technology. Then, we analyze the development of the OSS industry in the three nations. Finally, we provide discussions and implications.

NORTHEAST ASIAN OSS INDUSTRY: CURRENT STATUS, POTENTIAL AND THE GLOBAL SIGNIFICANCE

The CJK economies have become global leaders in the development and deployment of OSS (Associated Press Worldstream, 2006). China's Linux market reached US $11.8 million in 2005 and is estimated to cross US$51 million annually by 2010 (Global News Wire, 2006). Linux developers in China have persuaded firms in a range of industries such as public utilities, postal and telecommunications, education, and financial sectors to use OSS (Keong, 2004). Several big banks including the Industrial and Commercial Bank of China are planning to switch to Linux in the next few years (Lemon & Nystedt, 2005). In June 2004, a Chinese-made super computer "Dawning 4000A," which is based on a Linux operating system, ranked Number 10 in the top 500 list of the world's fastest supercomputers.[4] OSS has helped Chinese scientists to develop a wide range of technologies and technological standards such as third generation (3G) cell phones, WiFi, Authentication and Privacy Infrastructure and Radio Frequency Identification (Kang & Segal, 2006). China also made Linux a required course in 35 universities and 35 prevocational schools (SinoCast China Business Daily News, 2004). Likewise, through the China Academy of Science and Shanghai New Margin Venture Capital Corporation, China has established a Chinese-language Red Hat Linux distributor (May, 2006).

The South Korean government expects that OSS will account for 20% of desktop software and 30% of server by 2007 (Myung, 2003). In 2003, the South Korean government also announced that it will replace proprietary software on government computers and servers by OSS by 2007 (Kang & Segal, 2006). Analysts consider this move as a part of an initiative to create alternatives to Microsoft (Software Industry Profile, 2005a). In the mid-2004, the government allocated US$19 million to replace Windows OS and Office productivity suites in government bodies with OS programs (Keong, 2004). Many government agencies in South Korea have already adopted Linux desktop software (May, 2006). The government has also announced programs designed to encourage the use of OSS by local companies (Lemon & Nystedt, 2005). The South Korean firm, Hancom Linux, has also developed Arabic version of Linux and its office suite in the Middle East (Miller, 2002).

Japan falls a little behind in the OSS race (MSNBC, 2002), but is catching up rapidly. In Japan, IT heavyweights are pushing for OSS adoption. Fujitsu uses the Symbian OS for its 3G FOMA handsets. In March 2004, Fujitsu and Mitsubishi announced that they were considering joint development of Symbian OS-based mobile handsets for NTT DoCoMo's FOMA 3G cell phone services (Jiji Press English News Service, 2004). Sony is using Linux in its on-board auto-navigation systems (Hamm, 2005). To support the huge Asian character sets, TurboLinux was developed in Japan. In mid-2006, Japanese companies NEC, NTT DoCoMo and Panasonic Mobile Communications announced that they teamed up with Motorola, Samsung Electronics and Vodafone to establish a Linux-based software platform for mobile devices (PR Newswire Europe, 2006).

The CJK open-source alliance[5] has helped to further boost the OSS diffusion in the three countries (Table 1). The CJK initiative is guided by the Japanese IT Services Industry Association (JISA), the Chinese Software Industry Association (CSIA) and the Federation of Korean Information Industries (KFII). The three associations have over 1,000 corporations as their members, including nearly all major players in the Japanese and Korean IT industry. These associations have also recommended that government of each country should widen and deepen OSS adoption.

There has been a division of labor in the CJK partnership. China's role is to develop PC operating systems; Japan will concentrate on software development and security; and South Korea will develop software and applications for PDAs (Krikke, 2003). Among other things, they are working on a standardized operating system based on OSS for 3G mobile phones in Asia (Knight Ridder Tribune Business News, 2003). Since the region is far ahead of Europe and North America in terms of 3G retail sales volume (Table 2), such development is likely to further strengthen their leadership in the cellular 3G arena. South Korea's Haansoft Inc, China's Red Flag Software Co. and Japan's Miracle Linux Corp. are also planning to launch Asianux 2.0, a standard version of the OS operating system for Asia (Lemon & Blau, 2005). By the early 2006, the Asianux operating system was running on over 50,000 business servers of the three countries (Beijing Modern Business Daily, 2006). The three members are in the process of setting up a joint-venture company in 2006 to promote

and further develop a version of the OS operating system (Computerworld, 2006). The three governments are also planning to design Linux-based applications in many areas including home appliances (Nanfang Daily, 2006).

TABLE 1. CJK OSS Collaboration: A Timeline

Date	Explanation	Remarks
November 7, 2002	The four Standard Organizations in China, Japan and Korea (CCSA, ARIB, TTC, and TTA) signed an MoU for mutual cooperation.	
March 2003	The initiative to co-develop an OSS for large-scale use was first discussed (INQ7.net, 2003).	The discussion took place in a conference in Thailand that had over 100 software engineers from the CJK countries.
September 2003	CJK governments reached a basic agreement on the formation of a joint OSS project that could encompass desktop applications, embedded programs, middleware, and operating systems (Williams, 2003).	It was proposed by the then Japanese Minister for Economy, Trade and Industry at an Association of South East Asian Nations (ASEAN) meeting in Phnom Penh, Cambodia.
November 2003	CJK announced a partnership in Osaka to develop OS business models, standardize software and train software engineers. The partnership moved toward a division of labor: China–PC operating systems, Japan–software development and security, Korea–software for PDAs.	Krikke (2003).
November 14, 2003	JISA, CSIA, FKII had a summit meeting. The three organizations agreed to[a] • create CJK OSS Promotion to unite the activities of the three bodies. • make concrete action plans to accelerate the cooperation among the three countries and establish appropriate working groups. • recommend the governments to procure OSS in order to guarantee and improve the quality of the software.	
November 14, 2003	JISA held CJK OS Conference in Osaka.[b]	There were 190 participants from Japan, 60 from China and Korea taken together.
January 2004	China's Red Flag and Japan's Miracle Linux announced a strategic partnership to jointly develop Asianux.	*SinoCast China Business Daily News* (2004).
April 2004	Senior government officials from the three countries signed agreement in Beijing to work together to come up with an alternative computer operating system.	www.japantoday.com
June 2004	Codes for Asianux made available.	It was developed by China's Red Flag, Japan's Miracle Linux, and Oracle.
July 27-29, 2004	The Second Northeast Asia OSS Promotion Forum was held in Japan.	*Sino Cast China Business Daily News* (Aug 4, 2004, p. 1).
July 2005	Expected launch of Asianux 2.0.	

[a] "Towards OSS New Era from Asia," November 14, 2003, Osaka, http://www.jisa.or.jp/activity/newsrelease/OSS_press_en.pdf

[b] "Japan-China-Korea Open Source Business Conference," held in Osaka, http://www.jisa.or.jp/en/news/news-osb.html

TABLE 2. A Comparison of Major Economic and IT Indicators in CJK with Western Europe and North America

	Population (Million) (2003)	GDP, $, Trillion, PPP (2002)	Internet Users, Million (2003)	Internet Users, % (2003)	Cell Phone Users (2003)	2.5G Retail Volume, Million Units (2003)	3G Retail Volume, Million Units (2003)
CJK	1,474.3	10.2	193.8	23.70	384.1	33.5	14.6
EU-17	392.4	10.3	164.8	20.16	328.7	59.7	1.9
North America	315.0	11.0	188.1	23.01	158.1	38.8	–

Source: Authors' calculation based on data from Euromonitor International.

Given the size of the North Asian IT industry (Table 2), any technological standard they adopt has a potential to become the global standard. Technology marketers in the region are actively developing and exporting products with Linux pre-installed. To take one example, LG, a Korean company, for instance, exports Pentium 4 PCs to India loaded with Red Hat 8 and also provides comprehensive user training to the buyers. Thanks to low price of such PCs, they are gaining popularity in the Indian market.

GOVERNMENT ROLES IN THE CREATION AND DIFFUSION OF TECHNOLOGIES: RELEVANT THEORIES

We begin by considering the state's role in technology diffusion in a country. Government in a country can attack many of the barriers to technology adoption by legal and non-legal influences such as new laws, investment incentives, foreign technology transfer, and other supply-push and demand-pull forces (King et al., 1994; Montealegre, 1999). Many successful countries are characterized by governments' pivotal roles in overcoming barriers related to skills, information, market and infrastructures by such means. For instance, Singapore has been able to develop itself as an IT hub of Asia by providing attractive infrastructure, skilled workers and a stable labor environment which attracted a large number of IT firms to locate there (Kraemer et al., 1992; Wong, 1998). Similarly, strong university-industry linkages and a large pool of highly trained scientists and engineers, mostly supported by the defense sector, drive the technology diffusion in Israel (Porter & Stern, 2001). Moreover governments are the biggest single user of hardware and software, especially in most developing countries (Nidumolu et al., 1996) and for this reason, any decision they make about adopting a specific technology can have a powerful secondary compatibility effect on the spread and dissemination of the technology nationwide (Kshetri, 2004). In sum, these studies provide support for the notion that the government can play a critical role in the development of a country's technology industries.

With respect to the roles of a state, a model on technology "visions" offered by Hart (1998) is probably the most appropriate framework to explain a government's influence on the technology trajectory. Four of Hart's (1998) "visions" are relevant for tracking government role in the CJK OSS context: Associationalism, Reform liberalism, and Keynesianism and Defense against external threat.

Associationalism. The government helps overcome market failures that harm businesses by supporting information exchange, standardization, and research related to commercial technology. Theoretical and empirical evidence suggests that coordination between firms and the government co-varies positively with the success of a commercial technology (Lin, 2003). A failure, on the other hand, implies the inappropriateness of the industrial policy to other firms and they can avoid that failure by not following the policy (Lin, 2003).

Reform liberalism. The government can take standardization and other measures to overcome market failures arising from myopia, greed, and economic power that harm consumers. Governments thus can enact laws and devise policies to discourage monopoly pricing. In case of the existence of multiple standards, to maximize technological benefits associated with network externalities, it can also be prudent for a government to select a standard (Farrell & Shapiro, 1992, pp. 26-27). In this respect, a government may also deviate from an international standard (e.g., the U.S. government's deviation from OSI) and even erect technical barriers to trade for products related to the standard (Barrett & Yang, 2001).

Keynesianism. Technology policies are devised to maximize the contribution to national recovery and

macroeconomic stability (through taxes). For instance, governments in Western European countries charged $125 billion for licenses to build and operate 3G networks in the region.

Defense against external threat. It is widely recognized that modern technologies play an important role in the national security game. Science and technology policies thus tend to be directed towards minimizing military and economic threats from foreign countries.

GOVERNMENTS' ROLES AND MOTIVATIONS IN THE DEVELOPMENT OF THE NORTHEAST ASIAN OSS INDUSTRY

This section examines the rationale of government influence in the CJK OSS industry in terms of the four dimensions discussed in the previous section (Table 3).

CJK Governments Helping Businesses in OSS Industry

Governments in the three countries are pushing for the support of local manufacturers and vendors (Keong, 2004). They are providing a wide range of supports to help flourish the local OSS industry. In China, for instance, Linux development was the only software project on a list of government's top technology priorities in 1999. Similarly, Linux Internet server software and Linux mobile phone software were among the 19 projects identified by The Ministry of Information Industry (MII) in 2004 for IT fund, which was founded by the State Council in 1986 to encourage R&D in IT.[6] Moreover, the Government Procurement Law enacted in January 2003, requires government departments to procure domestic goods and services where possible[7] (Ebusinessforum.com, 2004). In early 2002, even before such law was enacted, out of seven government software contracts, six went to Chinese vendors. Despite China's accession to the world trade organization (WTO), government procurement is excluded from the scope of multilateral trade rules governing the WTO. Thus, China is not obliged to open its government procurement to foreigners. Estimates suggest that the government accounts for 25 percent[8] of the Chinese software market.[9]

TABLE 3. Role of National Government in Technological Standards in China, Japan, and Korea

Technology Vision	Pre-OSS Era	OSS Impact on Achieving the Vision	The CJK Collaboration Effect
Associationalism	Foreign firms' dominance in the IT industry	Support to local vendors	Regional opportunity for local firms
	Local firms' inability to catch up	Research fund	
Reform liberalism	High cost of foreign software	OSS-based products are cheaper	Common standards: low cost and high network externality effects
	Lack of ease of use		Division of labor: low-cost technologies to consumers
Keynesianism	IP royalty outflow	Saving in IP royalty	
Defense against external threat	Military and economic threat associated with proprietary software	OSS is more secure (Increasing military use of OSS in China)	

Similarly, in February 2002, the South Korean government announced that it would buy 120,000 copies of Hancom Linux and Hancom Office (Wall Street Journal, 2002). The South Korean ministry of information and communications helped open a Linux industry fair in Seoul in July 2000 (Bickers, 2000). In 2000, the South Korean government also conducted GNU/Linux training programs for systems administration (Festa, 2001).

Likewise, in July 2003, Fujitsu, IBM Japan, and Oki Electric Industry won an order from the Japanese government to design a new Linux-based system for personnel and salary management. By adopting Linux, the government estimated that it would reduce the running costs of about $7 billion to half (Jiji Press English News Service, 2003a). In 2003, the Japanese government was considering the Linux for its envisioned e-government project (Jiji Press English News Service, 2003b). In Japan, the government also provided $410,000 to a panel to conduct a study on government's Linux adoption.[10]

CJK Governments Protecting Consumer Interests

Potential low cost of IT products based on OSS is driving the development of the OSS industry in the three countries (Wahl, 2004). According to the South Korean IT Industry Promotion Agency, in 2003, a server based on Microsoft Windows 2000 designed for 25 clients cost US$1,510 for the operating system and an additional US$3,900 for other systems such as e-mail compared to only US$29 for the standard version of Linux-based server (Sung jin, 2003). Moreover, Microsoft products have failed to understand unique characteristics of the Korean (Wilkin, 2004), Japanese, and Chinese written languages. For instance, Chinese versions of Windows severely lack ease of use. They require a lot of keystrokes to create a Chinese character. Chinese consumers also believe that Microsoft's Chinese products are technically inferior to the English versions. Custom made OSS products are likely to enhance the economics of effective use in these countries (Kshetri, 2004). Finally, government agencies and many consumers in the three countries are not happy with Microsoft's business practices (Nystedt, 2006). In 1999 Microsoft China's general manager, Juliet Wu, left the company and wrote a book saying the company was "an enemy of Chinese consumers" because of its failure to reduce prices in developing markets (Meredith, 2003). Following the publication of the book, a number of government departments in China also reportedly blacklisted Microsoft (Meredith, 2003).

Similarly, in 2004, the Japanese antimonopoly authorities raided Microsoft's offices in Tokyo (McCurry, 2004; Yegeyama, 2004). Likewise, in 2005, the South Korean Fair Trade Commission ordered Microsoft to separate Messenger and Outlook from the Windows operating system. The commission also fined the company $33 million (Chae & McHaney, 2006).

Development of the OSS Industry for National Recovery

Foreign software, especially Microsoft Windows, dominates the CJK computing markets. Governments in the three countries want to achieve technological self-reliance (Chae & McHaney, 2006). In addition, the development of the OSS industry is also providing a possibility for more domestic talent to participate in the development of local software and is preventing the outflow of IT expenditures (Weber, 2005). For instance, China is the world's largest maker of DVD players. Adopting its own technology, it can save $2 billion a year in royalties being paid to an 18-company consortium (Calbreath, 2004). China thus wants to reduce the cost of IP (Roberts, 2006). Indeed, the Chinese government expects that the country's growth during 2005-2015 will be driven by inexpensive IP (Roberts, 2006). South Korean, and Japanese officials have also expressed their desire to reduce their countries' reliance on foreign software (Chae & McHaney, 2006). In sum, the three governments have seen OSS as a fast track to the development of domestic software industries.

This dimension is especially important for developing countries like China that are characterized by an underdeveloped IT market with few legacy systems and a nascent local software industry. Rapid development and deployment of OSS is one of the many structural shifts the Chinese software industry has been undergoing in recent years that has a potential to enhance China's position in the global IT map (Kshetri, 2005). To achieve the Keynesianism vision, among other things, the Chinese government created the Beijing Software Industry Productivity Center created to organize domestic Linux development. Similarly, the government-supported Chinese Academy of Science established Red Flag, Chinese language Linux distribution.

Employing OSS Against External Threat

As mentioned earlier, the IT markets in the three countries are dominated by Microsoft Windows and Unix (Krikke, 2003). Security concern associated with Microsoft Windows has been one of the major motivations behind the CJK collaboration (Heim, 2004). CJK governments have publicly stated a preference for OSS because of its higher security standards (Wahl, 2004). A Japanese spokesperson for the CJK initiative argued that the three countries found it unacceptable to rely on foreign software over which they lack control over the source code and the price (Krikke, 2003). Especially, the Chinese government is more concerned about national security associated with proprietary software. In an editorial on "information colonialism" in February 2000, the People's Liberation Army Daily wrote:

> Without information security, there is no national security in poitics, economics and military affairs.

While learning from others, China should not be under their control. (Goad & Holland, 2000, p. 9)

An article published in China Economic Times on June 12, 2000 discussed military security as one of the three mechanisms Xu Guanhua, then Chinese vice minister of the science and technology, thought high technology affects national security. Guanhua said that developed countries have put many hi-tech arms into actual battles and discussed the likelihood that technology-exporting countries might have installed software for "coercing, attacking or sabotage." In particular, the Chinese government thinks that Microsoft and the U.S. government spy on Chinese computer users through secret "back doors" in Microsoft products (Mahlow, 2003).

Continental Collaboration and the Achievement of Technology Visions

For more expensive innovations, companies are increasingly co-sourcing by collaborating with partners, mainly to share costs (Linder et al., 2003). International collaborations that are initiated and promoted by governments can be conceptualized to be broader than merely sharing costs. Governments evaluate collaborations in an IT project in terms of its contribution in achieving various technology visions and goals.

The division of labor in OSS projects, for instance, can potentially help the government in each country achieve multiple goals. First, the three countries have built a database to coordinate efforts in OSS projects and to avoid duplication (Krikke, 2003). Such measures can help overcome market failures for firms engaged in OSS projects-contribution to Associanalism. Second, the division of labor is likely to drive down costs and enhance quality and standards of OSS products leading to a positive impact on consumer welfare or Reform Liberalism. Officials from the three countries hope that OSS development in the region will create increased opportunities for Asian companies (NewsMax.com Wires, 2004). Opportunities for regional companies will lead to recovery of national IT industries of each country-contribution towards Keynesianism. Officials from the three countries have also reiterated that OSS is more likely to protect them from external threat than proprietary software over which they have no control.

DISCUSSION AND CONCLUSION

An important contribution of this paper is to analyze governments' roles in the development of the North Asian OSS industry. We discussed how the development of the OSS industry is likely to achieve various technology visions and goals for the governments of the three countries that are not possible with the innovation model associated with proprietary software. Continental collaborations in the OSS industry have worked as catalyst for achieving technology visions.

Motivations in developing domestic and regional OSS industries in the three countries, especially, for China go beyond Hart's technology visions. In the Chinese policy landscape, there has been a strongly expressed desire for the representation of "Chineseness" in information and communications technologies (ICTs). For China, domestic ability to develop a custom-made operating system is the matter of national pride (Lui, 2003). At this point, it should be emphasized that China's past attempts to set standards for the world have been unsuccessful. Since the 1980s, China made several attempts to develop a Chinese computer operating system, but failed because of the rapid movement of the global software industry (Goad & Holland, 2000).[11] Chinese are working very hard to create Chinese standards not only in the OSS arena but in a wide range of ICT sectors such as audio-video compression and third generation (3G) data standards (CNETAsia, 2003).

This paper contains some important managerial and policy implications. First, if the CJK collaboration produces good results, it will be important for global ICT players to integrate OSS in their strategies. Rapidly emerging applications of OSS in devices ranging from cars to coffee pots and supercomputers to cell phones, and the three Asian countries' increasing significance in the global ICT industry make integration critically important.

Second, if successful, the CJK collaboration is likely to bring a major structural change in the global ICT industry. For instance, China is already the world's biggest exporter of high technology products. China can capitalize on its leadership in the electronics industry and collaboration with global software giants to add value by bundling OSS with hardware products. Global software firms are thus likely to face major challenges.

Finally, since CJK have significant presence in the developing world, low cost associated with OSS is likely to boost the growth of the ICT industry in developing countries. As indicated earlier, the Korean multinational, LG's Pentium 4 PCs loaded with Red Hat Linux has boosted demand for the company's PCs in India, thanks mainly to low price. The Chinese PC company, Legend's subsidiary is already selling motherboards and other computer hardware products and accessories in many developing countries. OSS will help CJK companies to further lower costs and help increase PC penetration in the developing world.

NOTES

1. In OSS, the programming code is made freely available. A user can modify the code and even market the software, provided the user releases it as a patch file to the original document (see http://www.slais.ubc.ca/courses/libr500/02-03-wt1/www/K_ Parker/what.htm).
2. See SinoCast China Business Daily News, August 4, 2004.
3. See "China to buy 200 million desktop licenses from Sun," http://www.Pcpro. co.uk/news/50586/china-to-buy-200-million-desktop-licences-from-sun.html
4. See "List for June 2004" at http://www.top500.org/list/2004/06
5. For more expensive innovations, companies are increasingly co-sourcing by collaborating to share the costs (e.g., Linder et al., 2003).
6. See, MII Unveiled 19 Government-Sponsored IT Projects. SinoCast China Business Daily News. (July 19, 2004) 1.
7. Also see http://www.perkinscoie.com/page.cfm?id=534
8. In 2001, Chinese government's software purchase amounted RMB 4bn (US$500 million) and accounted for 14.1% of the Chinese software market, which was expected to double in 2002 (See: Software 'made in china' becomes procurement target of Chinese government, People.com, July 22, 2002, http://english.people.com.cn/200207/ 22/eng20020722_ 100153. shtml).
9. New Law In China To End Microsoft's Dominance, February 28, 2004, The Financial Express, http://www.financialexpress.com/fe_full_story.php?content_id= 53682
10. MSNBC, Tokyo Studies Switch to Open-Source Software, November 12, 2002, http://unpan1.un.org/intradoc/groups/public/documents/un/unpan014268.htm
11. China's attempt in the mid-1990s to introduce its CD standard, Super Video CD, to the world also faced foreign market resistance as well as a lack of strong consumer support within the country.

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