

The state of open source in Asia

While Japanese companies have doubled down on open source software collaboration, including in new areas such as auto, Chinese firms have been slower to embrace it, which risks isolating projects from a key emerging technology centre

By Keith Bergelt

As the inevitable benefits of collaboration inherent in open source software have come to be understood by companies seeking to offer the most innovative products and services, Linux, Open Stack and hundreds of other global open source projects have flourished over the last 25 years. Asia – the world’s most populated continent and a region replete with cultures which lean towards collectivism and long-term investment – has great potential to become a driving force in advancing open source. However, the continent is also extremely culturally diverse, making it difficult to paint with too broad a brush.

To understand the history of Linux – and by extension, open source software – in Asia, it is instructive to consider the history of open source on a country-by-country basis. This article focuses on Japan and China, given their economic and technological significance. Because Linux was first released in the early 1990s, this survey focuses on the period from the 1990s to the present day.

Community, shared values and innovation are at the heart of the open source software movement. The ability for organisations to cooperate on fundamental open source technologies, while still competing on high in the technology stack application layers as a source of differentiation, has driven significant innovation in existing industries and birthed new ones. It has also transformed where companies are inventing and codifying their inventions in the form of patents and defensive publications. Low in the stack, where companies collaborate and depend on building on each other’s ideas to maximise innovative output, is not an area for patenting. If patenting is to occur, it is better off high in the stack application layer functionality, where differentiation is increasingly found and where patenting offers the greatest benefit in supporting innovation.

Japan

The fundamental precept of open collaboration which underpins open source project-based innovation was not created in a lab in the United States or Europe; it has been standard business practice in Japan dating back to the end of the Second World War. Japan’s National Institute of Advanced Industrial Science and Technology – part of the famous Ministry of International Trade and Industry – worked with key manufacturers within strategic industries to ensure that basic technology

sharing occurred. It spurred significant innovations which generated global leadership positions for Japanese manufacturers in semiconductors, televisions and monitors, automobiles and music players, among many other sectors.

Japanese companies have come to understand the benefits of collaborative development and embrace the notion of ‘coopetition’ which Ray Noorda, former CEO of Novell, first identified as increasingly relevant in reference to the software industry in the early 1990s. For this reason, Japanese companies such as NEC, Fujitsu, Sony and, more recently, Toyota have come to embrace open source software projects and establish themselves as leaders in Asia and among the most sophisticated companies worldwide when it comes to the adoption of open source technologies.

Early open source adoption

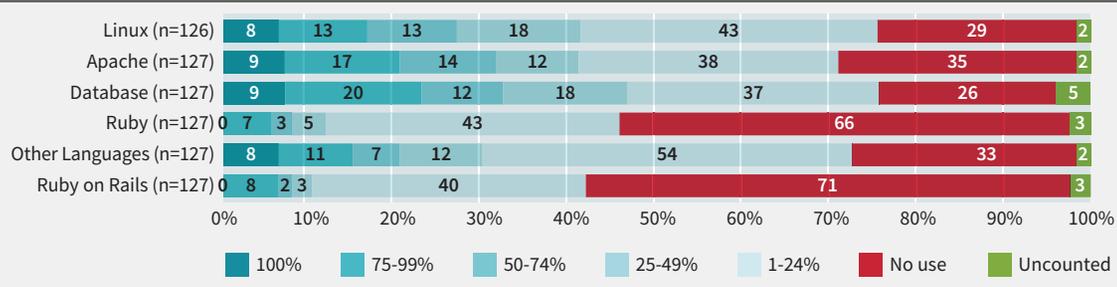
According to a 2004 study of open source developers conducted by Mitsubishi and titled “The Reality of FLOSS Developers in Japan and Asia”, most Japanese coders began, on average, to use open source in 1998 – approximately one year before most other Asian open source software developers.

There was also an early and healthy BSD community in Japan, especially around NetBSD. (Berkeley Software Distribution (BSD) is a Unix operating system derivative that is the basis for several open source development projects, such as FreeBSD, OpenBSD and NetBSD.) Japan was a nexus for NetBSD because of its portability and because there was a strong academic BSD tradition.

In Japan today, companies commonly use open source software. As Figure 1 illustrates, Linux, Apache and open source database technologies are used in over 70% of the Japanese companies that were surveyed in 2014.

The level of commitment since Japan’s initial adoption of open source has been exemplary. Through participation as both contributors and users of open source software project code, Japanese companies have set the tone for companies from Korea and China. In fact, NEC’s longstanding membership on the boards of both the Linux Foundation and the Open Stack Foundation and active participation in dozens of global open source software projects are evidence of its commitment to open source software and the powerful modality of open collaboration, which yields novelty and innovation that would not have been achievable

FIGURE 1. Open source software utilisation in Japanese IT companies, 2014



Source: Utilisation and Development Contribution of Open Source Software in Japanese IT Companies: An Exploratory Study of the Effect on Business Growth (second report based on 2014 survey), Tansho and Noda

through more traditional silo-based development approaches. Toyota's emergence as the driving force of the Automotive Grade Linux (AGL) Project and its recognition that Linux will in the near to medium term serve as the digital DNA of automobiles, supporting first infotainment and ultimately all mission-critical applications, is testament to its global leadership.

Japan's embrace of AGL has sparked a worldwide shift as an open automotive platform and now US and German original equipment manufacturers are also engaging in this important initiative – for example, Daimler joined the AGL Project in January 2017. As AGL expands beyond entertainment functionalities and adds more robust automotive management capabilities to its platform, it will become even more important to the automotive community.

China

Linux has been present in China for over 20 years, since 1996. Starting early on and continuing to today, Linux garnered support from the Chinese government, as highlighted by the request to remove Windows from all public offices and replace it with the Chinese Academy of Science-created Red Flag Linux in 2000. This support continued for several years, including government usage of Kylin (beginning around 2006) and support for the NeoKylin and Ubuntu Kylin (first released in 2013) Linux-based operating systems.

This top-down support from the Chinese government came about for a number of reasons, including:

- the desire to leverage Linux and its innovative capacity to boost China's IT industry;
- security concerns related to having foreign systems dominate the market; and
- the desire to gain a stronger bargaining position relative to western software suppliers.

However, Linux never managed to significantly penetrate the Chinese consumer or professional markets. Since piracy considerably lowered the cost of commercial software (a 2011 BSA study put the piracy rate in China at 77%), there was little perceived benefit to adopting free Linux for desktop computers. Therefore, demand from government procurement aside, Linux failed to become widely used in China.

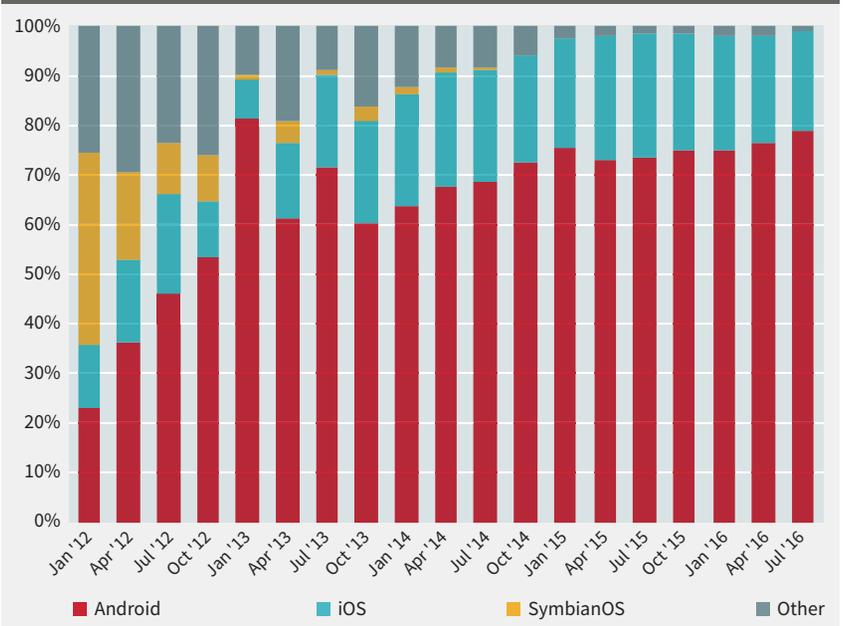
Things changed with the emergence of smartphones in the 2000s and particularly the release of Android smartphones in China in 2011. In early 2012, Android had a 23% market share in China, which has

grown to 79% today.

The success of Android made Linux (on which Android is based) widely used and available in China. Being freely available for use and modification, open source code is now used (incorporated either as infrastructure or as a component) in most software projects currently on the Chinese market. With China's growing software industry, Chinese engineers are exposed and increasingly familiar with open source software code, of which Linux is the key element. The Chinese software industry has also proved successful at creating indigenous consumer software, often incorporating open source software elements.

From the early 2000s to the early 2010s, Linux deployments on servers also increased rapidly. According to the IDC Worldwide Quarterly Server Tracker (Q4 2012), Linux growth in China surpassed the global average, with Linux servers rising from 9.2% to 33.2% of the total Chinese server market over the preceding 10 years. Given the scale that the Chinese computing market requires, increasingly

FIGURE 2. Market share held by mobile operating systems in China



Source: Statista

powerful infrastructure and higher processing speeds and the agility possible only through open source tools and operating systems, it seems likely that Linux penetration on servers in China will continue to grow. As the global reach of the Red Hat and SUSE enterprise Linux distributions expands in seeming exponential fashion, this likelihood increases dramatically.

Limited contributions

Unfortunately, Chinese contributions to free open source software development remain relatively limited. While Chinese companies are active in a number of open source software projects, China as a country has yet to exercise global leadership and launch the first China-driven open source software project – an important milestone which could be used to gauge open source software maturity. A fair amount of open source software has been adopted by Chinese companies and appears in Chinese products, but Chinese companies have contributed little to the open source software projects which are serving as the donors from which Chinese companies freely draw technology.

Historically, this has been driven by the view in China that contributing to open source software development requires a lot of effort without an obvious path to

reward. This was particularly true given that developers perceived a gap in their education relative to western contributors, both as it relates to open source software itself and with regard to the skills required to succeed in a global community of contributors.

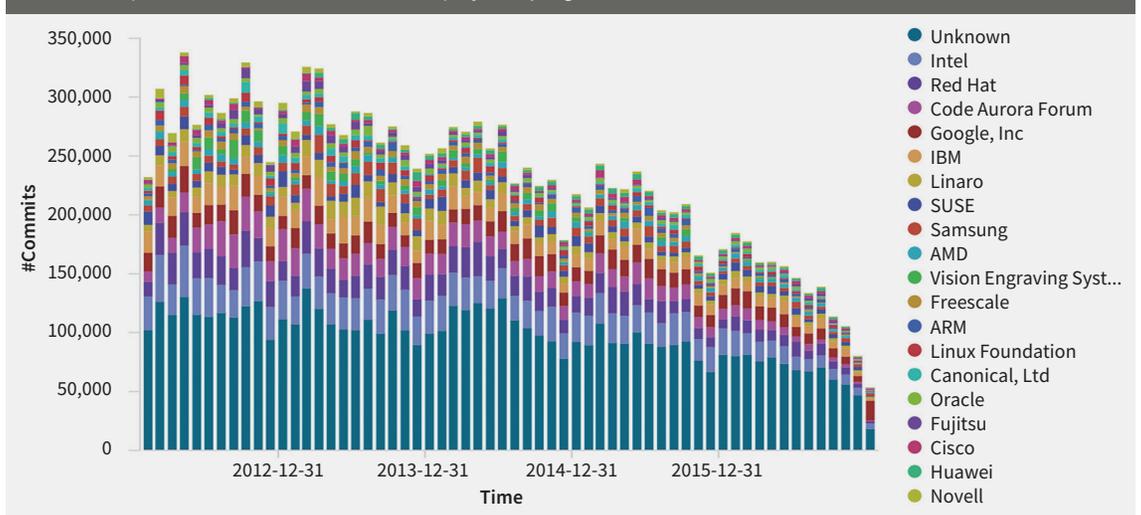
In recent years, this dynamic has improved. The Chinese software industry now offers greater career prospects related to free open source software projects. As an indication of this, in June 2017 the Linux Foundation’s LinuxCon and CloudOpen events will be held in China for the first time. In addition, around 1% of modifications in the Linux kernel – once considered the greatest of Linux achievements – are currently contributed by Huawei employees. Figure 3 displays the top contributors to Linux Foundation projects, broadly speaking, by organisation. Again, Huawei cracks the top 20 in terms of contributions to code – an important accomplishment.

Chinese companies in the telecoms space in particular are turning to open source software solutions in today’s environment. A lot of investment in this area seems to stem from the telecommunications carriers making strategic platform choices based on open source versus proprietary systems, perhaps influenced by the success of Android in smartphones. The telecoms equipment vendors which supply the carriers (eg, Huawei and ZTE) are supporting this by also turning to open source, including code development. It is hoped that through participation in the OPNFV and Open Daylight open source software projects, Chinese equipment makers and carriers such as China Mobile will be able to take advantage (as both users and contributors) of the transformation that is taking place in the nature of switching, transmission and network carrier operations occasioned by the introduction of Linux and associated open source software functionality.

Chinese banks, for their part, are beginning to turn to the blockchain technology and open source software

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FIGURE 3. Top contributors to Linux Foundation projects by organisation



Source: Linux Foundation

Note: Includes commitments to the Linux kernel, Kubernetes, Tizen, CAF, Yocto, Xen, Cloud Foundry, Dronecode, OpenDaylight, Node.js, OpenSwitch, ONOS, DiaMon, OPNFV, Let’s Encrypt, Zephyr, Open vSwitch, AllSeen, Hyperledger, IoTivity, OpenHPC, fd.io, OCI, Open-O, AGL, FOSSology, Kinetic Open Storage, IOvisor, PNDA, Open API, ODPI, Open Mainframe, TODO Group and R Consortium.

Action plan



The open source movement has sought to encourage companies to collaborate on the most fundamental layer of software, while innovating and patenting higher in the stack. Over time, a greater number of Japanese companies have joined in these industry-wide efforts. As China becomes a key global technology producer, its big tech players have been slower to participate in open source projects beyond those focused specifically on China. However, it is crucial to bear the following points in mind:

- The values of collectivism and long-term investment mean that open source projects are a good cultural fit for East Asian businesses.
- Japanese companies – including NEC, Fujitsu, Sony and, more recently, Toyota – have emerged as leading adopters of open source technology projects.

- Automakers from Japan are among the global leaders in pushing open source technology platforms to power the next generation of vehicle operating systems.
- Open source software was relatively slow to penetrate China's individual and commercial technology markets, and succeeded in doing so only when Android became a dominant mobile operating system.
- While many Chinese companies have adopted open source technologies, as a group they have made relatively few contributions to those projects and so far have not spearheaded initiatives of their own.
- A few Chinese companies – notably Huawei – are starting to contribute more to open source software projects, but the whole ecosystem would benefit from much broader involvement.

solutions being introduced by the Hyperledger open source software project. The Chinese government is pushing the use of this technology – which until this point was largely known for contributing to the emergence of Bitcoin – to increase transparency and combat fraud in its financial sector. Banks have struggled with outdated and disparate technology: many still use paper and traditional chop stamps to verify documents, despite being among the world's largest banks in terms of capital. While the open source software community is seeing usage and participation in China rise in this sector, to date there has been no significant code contribution from China to blockchain.

Great Firewall

Clearly, the IT world would reap substantial benefits from greater development of open source software in China, especially given the size of the pool of potential contributors. However, the so-called 'Great Firewall of China' – essentially, a closed Internet – has clearly had a dampening effect on global collaboration between developers within China and elsewhere in the world. There are also real risks if Chinese companies do not ultimately engage as important global contributors in open source software development: not contributing to such worldwide projects is hardly a recipe for global inclusivity and interoperability, and all the benefits – such as enhanced technological innovation – which arise out of worldwide collaboration.

However, the signs are promising. In September 2016 Baidu announced that it would license machine learning platform PaddlePaddle under Apache, an open source licence. In December 2014 China's Ministry of Industry and Information Technology declared its support for OpenStack for state-owned enterprises. Not long after, Tencent embraced the Open Daylight open source software project's software defined network, instead of developing its own proprietary solution. Today, Alibaba, Baidu, China Mobile and Tencent are all silver members of the Open Daylight Foundation. Taken together, these developments suggest an ongoing shift in how China thinks about software and how its companies position themselves with regard to global trends.

Non-aggression

As a partner with the Linux Foundation's open source software projects and those managed elsewhere, Open Invention Network (OIN) was formed to promote the development, distribution and use of Linux and adjacent open source software technologies. By establishing a patent non-aggression zone comprising core software code central to Linux and other key open source software projects, and in so doing promulgating a set of cultural norms around how companies use patents in an increasingly open source software-centric world, OIN has emerged as a structural guardian of open source software projects.

In fact, given the leap forward in the depth and breadth of Linux and open source software technology usage which has occurred over the last 10 years, in particular, OIN has grown to include over 2,100 global participants which recognise the importance of forgoing the right to use patents to file patent infringement lawsuits on core Linux and open source software technology in favour of patent non-aggression in core open source software technologies.

It is now anticipated that the near-uniform inclusion that OIN has secured from open source software-project participants in enterprise, mobile computing and communications will be followed by similar levels of participation from automobile, banking and financial services and telecommunications carrier ecosystem member companies. This is particularly true given that OIN's community participation grew more extensively in Asia than anywhere else in the world between 2012 and 2016, when Asian participation rose from 12% to 22% of the total OIN community – even while the global OIN community more than doubled during the same period.

As open source software continues its inexorable growth, Asia has great potential to become a significant force in advancing open source development globally. Given trends in technologies, industries and intellectual property, there are many reasons for Asian organisations to look to open source software and the associated concept of patent non-aggression to fuel their ongoing success. **iam**

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