

INTERACTIVE SESSION TECHNOLOGY

Open Source Innovation: The New Competitive Advantage

Open source software is computer software whose source code is distributed freely and can be modified by anyone. The open source movement started as a response to the high cost of, and restrictions on, proprietary software. Initially, open source software was created and maintained by communities of users. Famous examples include Linux, Apache, and Firefox.

In the late 2010s, a new trend arose: companies began to release their proprietary software as open source. This phenomenon, known as open innovation, aimed to increase the pace of innovation by relying on users for new ideas and features instead of just relying on a small, internal group doing R&D. This marked a dramatic shift in mindset, from competing based on proprietary intellectual property (such as patents or copyrights) to competing through opening up and sharing. Two prominent examples of open innovation are Baidu and Fujitsu.

Based in China, Baidu is the leading search engine company in China and the fourth-most visited site in the world. It is often dubbed the “Google of China.” Besides its core search services, Baidu offers community cloud services, an online video platform, maps, takeout delivery, online and mobile payments and more. To power these services, Baidu was relying more and more on AI. In 2016, in a move that took the IT world by surprise, Baidu released the source code and documentation for its AI software, PaddlePaddle (PARallel Distributed Deep LEarning), which had taken three years to develop, on the open source development platform GitHub.

PaddlePaddle is a framework based on deep learning, a promising field in machine learning and AI. It develops algorithms from huge amounts of data inputs by inferring patterns and using sophisticated classifying and predictive capabilities. It also supports neural network architectures, such as convolutional and recurrent neural networks. Today, PaddlePaddle powers more than 30 of Baidu’s offline and online products and services, used across a variety of industries, including finance and healthcare. For Baidu’s takeout business, for example, it calculates the time for food to reach customers. It is also the brains behind speech transcription in Chinese, translating speech-to-text for broadcast transcription and for smartphone speech interfaces. Other examples of functionality supported by it are search ranking,

advertising, image classification, machine translation, and optical character recognition. PaddlePaddle’s core libraries are written in C++ for speed, and it is scalable to a large number of CPUs or GPUs on multiple machines.

In 2020, Baidu made a new toolkit for quantum machine learning, known as Paddle Quantum, available on GitHub. Paddle Quantum is designed to be used to build and train quantum neural networks. Baidu also open-sourced tools for a variety of enhanced features for the PaddlePaddle framework, which is now being used by more than 1.9 million developers at 84,000 businesses.

A similar example comes from tech giant Fujitsu, a leading Japanese multinational information and communication technology company employing 130,000 employees in more than 100 countries. The company recognized that it was critical for it to move from its traditional products and services to the Internet and the cloud, and this drove it toward open source.

One of the opportunities identified by Fujitsu was multi-cloud environments. Cloud services offered by providers such as Amazon and IBM have different access methods and billing systems, and they lack a set of standardized technologies to link the different clouds together. To address this gap, Fujitsu created the Open Service Catalog Manager (OSCM), open source software based on Fujitsu’s Systemwalker Service Catalogue Manager. OSCM allows different cloud service providers to list and manage their services and also enables customers to get integrated billing from different providers. OSCM has been certified by OpenStack and can be integrated with various service providers such as Amazon Web Services and Microsoft Azure. Fujitsu thus created an industry-wide, vendor-neutral open source platform for delivering cloud services.

Both Baidu and Fujitsu used a non-traditional approach to enhance innovation and product development in their companies. Baidu wanted to keep up with other global tech giants who were already releasing their AI code, such as Facebook’s Torch toolkit and Google’s TensorFlow. Besides a competitive necessity, this was also an attempt to access and attract deep learning expertise to enable Baidu to counter the trend of AI professionals increasingly concentrating in a few global companies that are becoming

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intellectual monopolies. Fujitsu meanwhile adopted an open source strategy because keeping its software proprietary was no longer very profitable. In addition, it realized that there was much greater scope for innovation and expansion with the participation of the community. Finally, it was an opportunity for Fujitsu to pioneer a platform and develop new competencies without a lot of investment.

In addition to the many expected benefits, such as lower cost and faster pace of innovation, both Baidu and Fujitsu enjoyed many unexpected benefits. Baidu's undertaking became the springboard for AI innovation in China, opening the door to a variety of deep-learning applications in all facets of society, such as business, healthcare, and transportation. Fujitsu became the partner of choice for vendors using OCSM and companies such as ImageWare

Systems, which builds cloud-based identity-management solutions.

Sources: "Baidu: Investors: Company Overview," ir.baidu.com; accessed December 17, 2020; The Linux Foundation, "Lightning Talk: Making Business by Contributing to Open Source-Gu Jinxiang, Fujitsu (FNST)," www.youtube.com, December 15, 2020; Mike Wheatley, "Baidu Open-Sources Its Paddle Quantum Learning Toolkit on Github," www.siliconangle.com, May 28, 2020; Libby Clark, "Fujitsu Open Source Project Aims to Be Front End for Cloud Foundry Service-Broker API," www.linux.com, October 11, 2016; John Ribeiro, "Baidu Open Sources Its Deep Learning Platform PaddlePaddle," www.pc-world.com, September 1, 2016; James Vincent, "Baidu Follows U.S. Tech Giants and Open Sources Its Deep Learning Tools," www.theverge.com, September 1, 2016; Serdar Yegulalp, "Baidu Open-Sources Python-Driven Machine Learning Framework," www.infoworld.com, September 1, 2016; "Fujitsu Upgrades Biometrics-as-a-Service with Latest Catalog Manager Marketplace and ImageWare's GoVerifyID," www.fujitsu.com, July 14, 2016; Swapnil Bhartiya, "Fujitsu Releases Its First Open Source Project: Open Service Catalog Manager," linux.com, December 7, 2015.

CASE STUDY QUESTIONS

1. What is open source software? How is it different from proprietary software?
2. What motivated Baidu to make its AI software open source? How did Baidu benefit from open sourcing?
3. Why did Fujitsu adopt an open source strategy? How did Fujitsu benefit from it?

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HTML was originally designed to create and link static documents composed largely of text. Today, however, the web is much more social and interactive, and many web pages have multimedia elements—images, audio, and video. Additional programming was required to integrate these rich media with web pages, putting strains on computer processing. The next evolution of HTML, called **HTML5**, solves this problem by making it possible to embed images, audio, video, and other elements directly into a document without processor-intensive add-ons. HTML5 makes it easier for web pages to function across different display devices, including mobile devices as well as desktops, and it supports the storage of data offline for apps that run over the web.

JavaScript is another core technology for making web pages more interactive. The vast majority of websites use JavaScript for client-side page behavior, and all major web browsers have a built-in JavaScript engine to execute it very quickly. JavaScript runs very fast and is able to instruct the computer on how to interact with the user upon receiving user input.

Other popular programming tools for web applications include Python and Ruby on Rails. Python is known for its flexibility in scaling web applications, its ability to run on most platforms, and its ease of use. Ruby on Rails provides a framework with tools for building feature-rich websites.