The Future of Chinese Software Development

To most people, “massive systems” probably means those systems run by NASA, airline companies, or large banks, or operating systems such as Microsoft Windows. What’s in common? They all have complex components or subsystems, deal with massive data, support millions of customers, require real-time response, and more. If they malfunction, catastrophe might ensue.

By those standards, many systems run by today’s Internet companies also qualify as massive. As the Internet grows so quickly, many Internet companies are suffering the same problems that massive systems have suffered. I previously worked for Internet giant Alibaba for eight years. I now work for a fast-growing Internet company called Tuniu.com. My experience tells me that future software development for Internet companies will face the same challenges that traditional massive systems have faced, or even bigger challenges. So, software development for massive systems will be very important for many Internet companies.

Most Internet companies grow very fast and tend to quickly acquire complex components or subsystems. For instance, within five to six years, Tuniu.com had already accumulated more than 100 subsystems, covering Web front ends, mobile apps, and systems for customer relationship management, supply chain management, order management, pricing, finance, human resources, and office automation.

In such a situation, tools are critical. Other than typical tools for requirements management, project management, code management, testing, and configuration management, Tuniu.com relies heavily on its monitoring systems. They monitor a broad spectrum, from system health data for the CPU, memory, and I/O; to API-level response time; to user experience issues such as payment delays, to business-level results such as hourly order volume. Because the monitoring data is broad, developers have opportunities to see the bigger picture and make better decisions.

For example, Tuniu.com sales usually follow a pattern. Order volumes between 10 and 11 a.m. on Tuesday mornings are similar, with some slight increases over time. If, on a particular Tuesday morning, the order volume drops sharply—say, 30 percent—the system detects that abnormality and sends alarms to developers. Developers might relate this information to other monitoring data and troubleshoot more quickly. Such scenarios happen from time to time. But with the...
monitoring tools, the problems are quick resolved, and business risks and losses significantly decrease. Future software development will need to tightly integrate monitoring tools.

Also, I believe that computing large data will become common. Thanks to big data, the technologies for storing and retrieving large volumes of data are mature. The next logical step is how to compute and use that data.

Tuniu.com mainly sells vacation packages, which differs from selling single standard items. For example, the iPhone 6 is a standard product such that it varies only in color and storage size. Once a customer selects the storage size, the price is normally fixed. So, displaying the iPhone 6 as a product is simple.

In contrast, displaying a vacation package is complicated. For instance, the “7-Day, 6-Night 4-Star Luxury Paris Tour” vacation package includes round-trip plane tickets, six nights at four-star hotels, and so on. Most customers perceive this package as a single product and want to see only one price at first glance. This “simple” requirement complicates things in the background. Because the travel date is unknown, Tuniu.com assumes the customer will travel within the next six months. Given that the plane ticket prices and hotel prices might be different every day, for the next 180 days there might be more than 10,000 combinations just for this package. Tuniu.com then calculates all the combinations, finds the lowest price, and displays it to customers. The pricing system now handles more than 10 billion calculations a day and should soon break the 100-billion mark.

Other companies might have different computation requirements. Companies should prepare for this by spending resources on distributed systems and parallel computing.

In addition, I believe that future software architectures will employ an evolved version of a client-server model in which the clients are mobile devices and the servers store big data. The clients will be smart, and the servers will be distributed. The client side will need to focus on the user experience and be agile. The server side will require the capacity to handle big data, security, and integrity. Balancing the client and server will be a challenge for software development.

As I mentioned before, future software development for Internet systems will face the same challenges massive systems face, or even bigger ones. Tuniu.com’s practices regarding monitoring tools, big-data computing capability, and client-server architecture are very effective. I hope my company’s experience will be helpful to others.

Best Software Engineering Practices at Tuji.com

Melissa Yang

When I left China for graduate school in the US 20 years ago, China’s software industry almost didn’t exist. At the time, Zhongguancun,
First, we have two types of releases. Weekly releases mainly include bug fixes and small features. In monthly releases, big features go live. This lets us maintain a good balance between constantly rolling out improvements and being efficient with coding and bug regression.

Second, we use open source for multiple platforms and tools. We originally built Tujia on Microsoft .NET for various reasons. Although .NET is sufficient technically, our business grew fast, and we had difficulty finding enough good .NET developers as quickly as we wanted. We decided to get Java developers meanwhile. Because our architecture is well designed with clear interfaces, we could build a Java deck and quickly implement some core components in Java. The process has been smooth. The system now has various services built on Java or .NET. The key is that the foundation is a well-componentized architecture.

Third, we perform A/B testing. Sometimes it’s hard to tell which design provides a better user experience and thus a higher conversion rate, especially given that vacation rental is still a new concept for most Chinese travelers. In these cases, we A/B-test different designs of key features and draw conclusions based on the results.

The final practice relates to mobile apps. Although we immediately upgrade our websites, we handle apps a little differently. Upgrading app versions can help us obtain a better position in some markets but can be time consuming and unpredictable. This is especially true for iOS apps. Our statistics show that approximately 70 percent of our iOS users automatically upgrade an app within a month; the remaining 30 percent wait several months.

So, we’re careful to distinguish core business and variable scenarios when designing apps.

I was lucky to work at a couple of great software companies in the US for over a decade. I think that, compared to US companies, Chinese companies move faster and are more competitive. So, new products go live more quickly, and sometimes quality and architecture are subordinate to speed. In many cases, any issues are later fixed by re-architecting. Chinese software companies are learning fast, and many have come up with their own best practices. It’s a great time for software developers in China, and I’m excited to be part of it.

The huge volume of transactions on such shopping events puts huge pressure on software and information systems. China e-commerce firms’ business, operations, and technology all center on these events. This event-driven nature reshapes entire software engineering processes, affecting development methodology and organization structure.

In the software system context, an event-driven architecture is a framework that orchestrates behavior around the production, propagation, and consumption of events. An event consists of event creators and consumers. A similar approach works for e-commerce. In that context, event creators or organizers are sales, marketing, and engineering teams. Event consumers or subscribers are online and offline consumers. All company activities are organized to implement and support these sales events. I call this event-driven software development (EDSD).

Let’s look at four aspects of an EDSD project.

The first is event objectives. Obviously, the ultimate goal is sales. But what are other goals—for example, profit, growth, new user registration, or brand recognition? Clearly defined objectives are key to event success.

The second aspect is project management and execution. EDSD
projects have three characteristics: hard deadlines; short project cycles, usually taking weeks but sometimes up to six months; and constant change. Although event objectives are usually fixed, the requirements and implementation change frequently. Agile software development is a natural choice to adapt to changing requirements.

The third aspect is organization. Typically, an e-commerce company has groups for purchasing and the supply chain, operations, products, R&D and design, public relations and marketing, and the user experience. A major sales event—for example, a flash sale or auction—usually comprises a series of activities. Activity-based or task-oriented task forces and virtual teams are usually formed to carry out these tasks. A dynamic, cross-functional organization is better suited in EDSD.

The final aspect is infrastructure challenges. The event-driven nature of e-commerce sales events greatly affects IT infrastructure, system capacity, performance, scalability, security, and robustness. Developers regularly perform performance and stress tests to guarantee system performance, stability, and scalability. They usually perform penetration tests to find a system’s potential weaknesses. Other proven software engineering practices such as test automation, DevOps organization, and continuous integration are common in e-commerce engineering teams.

More and more companies will likely use EDSD. Technologies such as machine learning will help EDSD’s adoption as well—for example, by automatically generating targeted audiences, merchandise, discounts, and timing. While practicing EDSD, companies will need to balance between short-term events and long-term infrastructure buildup. Software teams will also need to collaborate well with nonsoftware teams. Sales operations and marketing teams aren’t trained software engineering professionals. Effectively engaging and collaborating with them in EDSD projects will require good communication and well-designed, yet flexible processes.

The advent of object-oriented design (OOD) and object-oriented programming (OOP) caused a paradigm shift on how we model the real world. Software systems evolved from procedural systems carrying out tasks step by step to systems comprising interacting objects. This reflected the real world more accurately, resulting in highly interactive, adaptive software systems. In Chinese e-commerce, which is full of sales events year-round, thinking of e-commerce as a series of events and using EDSD might generate benefits similar to those of OOD and OOP.

**A Growth Perspective on the Chinese Software Industry**

John Liu

The Chinese software industry is experiencing exciting, tremendous growth. According to the Chinese Ministry of Industry and Information Technology, the Chinese software industry’s annual revenue grew from 1.3 trillion yuan in 2010 to 3.7 trillion yuan in 2014, a compound annual growth rate of 30 percent. This trend will likely continue into the next decade thanks to favorable government policies, growing demand for information infrastructure and services, fast-paced innovations from aspiring high-tech startups and industry heavyweights, and a steady supply of software engineering professionals.

Realizing the strategic importance of developing the domestic software industry, the Chinese government has launched incentive programs offering free office space, high-tech incubators, and other economic subsidies to stimulate the growth of China’s software industry and high-tech industry in general. The Made in China 2025 initiative, a 10-year government plan to propel China’s manufacturing industry to a world-class standard, also calls for developing systems software, cloud-computing infrastructures, big data, and their applications in industrial settings.

With 649 million Internet users and 557 million mobile Internet users as of December 2014, China has the largest Internet population. The explosive growth in Internet and mobile services, e-commerce, social networking, cloud computing, big data, and the Internet of Things has enabled a few Chinese Internet and e-commerce companies to become some of the largest in the world. This has in turn provided the demand and resources for innovations in the Chinese software industry. The proliferation of open source software has significantly lowered the entry barriers for software and Internet startups by...
providing a platform to create innovative software services and solutions for enterprises and end users alike.

China’s ever-growing, ever-maturing software talent pool is well positioned to power the Chinese software industry forward. Over the past two decades, thousands of experienced software professionals from overseas have come to work in the Chinese R&D centers of the world’s leading software companies, such as Google, IBM, Microsoft, and Oracle. Many of them have chosen to remain in China. These companies have also employed and trained tens of thousands of software engineers with degrees in computer science and related fields from Chinese colleges. A growing number of these experienced software professionals have since “graduated” from their multinational employers and joined the local software industry or started their own companies. Their experience and expertise, along with their deep understanding of the Chinese market and user needs, have enabled them to build quality software systems and applications. This has fueled the growth of the domestic software industry, whose success relies heavily on skilled talent.

Big data is a particularly exciting area expected to drive innovation and growth. As a clear sign that China has entered the big-data era, the nation’s first Big Data Expo took place on 26 May 2015. In a congratulatory letter, Premier Li Keqiang stressed that “data is a basic resource and an important productive force. Big data, combined with cloud computing and the Internet of Things, is rapidly changing ways of production and living.”

Although a growing number of public organizations and private enterprises are realizing the potential value in the massive and rapidly increasing amount of available data, the big-data industry is still in its infancy in China and faces tremendous challenges. Most enterprise IT departments lack the resources and skills to capture relevant data and make it useful for decision makers and employees. The industry is experiencing a shortage of data engineers, analysts, and scientists.

The government and the industry need to work together to solve data security and privacy issues and to make public data more readily available and usable. In addition, there are interesting and challenging technical problems in analyzing structured and unstructured data at scale in real time. These challenges will present significant growth opportunities for the Chinese software industry.

As a software professional with 20 years’ experience in the US and China, I’m very optimistic about the growth and future of the Chinese domestic software industry and the innovations it will bring to China and the rest of the world in the next decade.

References

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