DATA VALUE CHAIN AND SERVICE ECOSYSTEM: -A WAY TO ACHIEVE SERVICE COMPUTING SUPPORTING "INTERNET +"

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Abstract

"Internet +", the application of the internet and other information technology in conventional industries, is the basic strategic direction of enterprise development. The paper proposes that service ecosystem based on data value chain, which is supported by service computing technology, is one of the most effective solutions to realize this strategy. The paper analyzes the development of service computing, explores the formation of data value chain and presents the actual "Internet +" scenario application. Armed with the origin, structure and application of the proposal, we hope that the future business and research can be inspired greatly.

Keywords: DATA VALUE CHAIN, SERVICE COMPUTING, INTERNET PLUS

1. INTRODUCTION

In the era of “Internet +”, many big hot topics such as big data, cloud computing and Internet of Things have emerged one after another. However, their values have to be realized in the form of service. Under this circumstance, we introduce the data value chain-driven service ecosystem, including its formation, development and concrete application from the perspective of service computing. The rest of the paper is discussed from three aspects: the first is the development trend of service computing, followed by the data value chain-driven service ecosystem, and finally the "Internet +" application scenario.

2. THE TREND OF SERVICE COMPUTING

2.1 THE CONCEPT OF SERVICE COMPUTING

The development of software and hardware has always been the major division of computing science in the past. However, at that time, there was no mature scientific system or research direction of how to realize the commercialization of computing technology, how to enhance the commercial value of technology in these directions. Service Computing science happened to make up for this deficiency.

Service Computing is a cross-disciplinary study of how to use the latest information technology and computing technology to create new business services, enhance the existing service levels and turn products into services. It is also an effective way to integrate business and service technology as an organic whole of science and technology in general. The "service" refers to the field of business, and "computing" refers to the support technology. The combination of the two is a realization of technology producing the perfect business value.

As a macro disciplinary field, "service computing" itself is not similar to technical or industry-specific terms, such as service-oriented architecture (SOA), cloud computing, and big data. Because industrial technology is apt to change rapidly, the ultimate value of these computing resources, or the way they are integrated into the computing system, is always presented in the form of service. Therefore, the "service computing" itself has extraordinary potential for inclusive and sustainable development.
In 2001, the author and relevant colleagues began to convene the Web Service computing Workshop. By 2003, this working group has developed into the technology community of IEEE Computer Society with recognitions of many experts in this field. Finally, the discipline of Service computing is formally established.

2.2 SERVICE COMPUTING CORE TECHNOLOGY AND APPLICATION AREAS

In terms of the core technology, the SOA widely used in the current service computing is an architectural model. In other words, it is based on Web, Mobile, IoT and other support technologies and takes cloud computing technology as a delivery platform so as to achieve the organic integration of business process management and IT services.

In terms of the application field, service computing covers the entire lifecycle of service innovation, namely, consultation, modeling, design, solution, service delivery, service marketing, service operation and management.

Figure 1[1] depicts the service model as a high-speed train. The content that the train carries are the service industry objects, including finance, insurance, government, medical, manufacturing, the Internet and so on vertical industry area. The engine of the train is the core of the service computing. Its external performance is achieved through the specific model of large data services, Web services and mobile services. Cloud computing technology provides a driving platform for the train. Train as a whole is actually the object of service computing research and development (R&D), which is named service ecosystem.

A mature service ecosystem should cover the following stages:

First, the computing resources of the modular. Its goal is to extract and integrate a certain capability of a computer that may be applied only within an enterprise or within a certain R&D team. This stage is for the internal technological innovation and application.

Second, the value of services. The technological achievements accomplished at the previous stage should be available to all users through the Internet. This stage is for the concrete external service.

Third, service integration and reconstruction. In the collection of various types and diverse interactive forms of service, we aim to realize coupling of services and exert a greater value, to form a social, comprehensive and highly interconnected service network and architecture, and finally to establish a vital service ecosystem. It is the main task and goal of this stage. In the service ecosystem, data is the underlying performance of all resources, technology is the primary means of data linkage, and the service system itself is a set of transcendent ideas and
relationships. The organic combination among them can eventually form a complete and reliable service ecosystem (a high-speed train shown in Figure 1) in the future.

Broadly defined service ecosystems can also include service integration and planning across a variety of industries (traditional services, financial services, Internet services, etc.). In fact, the current development of the world also indicates that the globally industry-wide service ecosystem is gradually taking shape. It is easy to discover that the all walks of life overflow with the emerging technologies with cross-science innovations. It also indicates that, at present, a single area of service cannot satisfy the growing demands of people. On the basis of the mature technology, the service composition and integration gradually becomes the standard, which is the main trend of modern society. This paper describes the specific connotation and application of the service ecosystem in the Internet service ecosystem provided by enterprises under the Internet system.

3. **DATA VALUE CHAIN DRIVEN SERVICE ECOSYSTEM**

3.1 **EVOLUTION OF SERVICE ECOSYSTEM**

Software services are split into reusable internal components or modules from the original software code with functional blocks and annotations. And then, it turns to utilize the SOA concept of its services, that is, the use of API method or service interface, and ultimately the Internet services. Consequently, all these services from different industries, areas and enterprises will be aggregated so as to meet the requirements of the corresponding business scenarios. The business scenario is driven entirely by the consolidation of data and value chains across all industries. This is the evolution of the entire service ecosystem.

3.2 **THE ERA OF DIGITAL ECONOMY [2]**

In the current world, 1.3 billion people communicate with each other via social networking services (SNS) every day. There are about 9 billion sensors tracking transaction data for people, products, vehicles, weather, trading and so on. It is obvious that a variety of communication channels such as media communications produce large amount of data from tremendous services all the time.

The environment we lived in with large amount of data is described as an era of digital economy. This term originated from the industrial world is widely used. Forbes magazine summarizes the essentials for the survival of enterprises in the era of digital economy. First, make full use of SNS as marketing media. This marketing approach is unconventional: the marketing object is not only the physical or virtual goods in the traditional sense, but more likely the information and data itself. Such path-breaking marketing is the primary ability of enterprise to survive in the digital economy. Second, the enterprise business should be efficiently and organically integrated with the customer's personal life. In other words, we should make full use of data to understand the fundamental needs of users, and then create products which users cannot live without, like technology applications of smart car. Users of smart cars probably do not need to learn how to drive, and thus they cannot leave the smart car products any more, unless employing a driver. Third, enterprises and individuals have to establish thinking habits adapted to the high speed development of digital economy. Enterprises must exploit new media and high technology, explore data value, keep up with the pace of the times, and finally find its place in the digital economy.

3.3 **ENTERPRISE INFORMATIZATION TREND: VIRTUAL DISK**

The development of the digital economy has led to a strong focus on data of business and organization. The data comes from diverse channels, including the internal information systems of enterprises, the external Internet, a variety of social media, the introduction on company products and user feedback. After forming the integrated data of user and employee behaviors and habits, these data will be aggregated and precipitated. With the aggregated data, what the enterprise or organization need is only one hard disk, or cloud disk, just like one computer only has one hard disk. Only in this way can the data become the strategic business-type assets.
We explain the Kingdee cloud disk as shown in Figure 2, namely, the structure of my cloud disk. We can take the PPT in the Presentation Reports folder as an example. The PPT is not only visible and modifiable to an individual, but is also transparent to all the colleagues and leaders because it is within the enterprise cloud. What's more, corporate and personal from external social networks can also share this document directly.

![Figure 2. Kingdee Cloud Disk](image)

### 3.4 DATA SHARING AND DISSEMINATION

After data is stored in the enterprise cloud, we can develop many new applications to invoke them, so that it produces new value.

For example, the PPT in My Clouds can be invoked by another application (such as Kingdee Action Flow) and its data can be viewed. Armed with this application, we can build a "free collaborative flow" to manage projects, including creating a new team named "NCSC2015 Report" and setting up a new project in the team called "ppt preparation" to facilitate team communication and collaboration.

Let us suppose that we need to integrate three parts of the PPT, as shown in Figure 3 on the left of the first screen: enterprise cloud data, project management and knowledge dissemination of cloud services. Through the approach of "associated file", we transit the temporary PPT draft from the cloud disk to the link of "enterprise cloud disk", and hence team members can see the first draft of the document. It should be noted that any of the three basic steps shown in Figure 3 can be associated with a single responsible person and can show the progress status of the task, thus connecting to the Internet and all resources within the enterprise. In addition, the order of these three tasks can be changed at any time. The example shows that the future of business process management in the mobile Internet is becoming available, and can be adjusted at any time.
3.5 THE FORMATION OF DATA VALUE CHAIN

The data value chain is not just the data supply chain. A data chain called the data value chain only if the data is reusable and able to generate new value, or if the change is derived from the new data on every stage of the chain. A typical effect of value-added data is that it can provide decision-making services for the company.

Utilizing the concept of data value chain, the traditional development methods of application software will change drastically. Each data set needs to provide an open interface to generate new data integration with the entire cloud platform. Besides, any new applications can invoke them in the form of services. In this way, the concept of traditional data supply chain can be put into the practice of data value chain. At the same time, changes in the application architecture will also promote the changes of developing methodology.

3.6 THE CORE OF THE DATA VALUE CHAIN: USER DATA

The integration of data from different enterprises and organizations as well as different data services through the data value chain leads to a wide range of data sets, among which, the most important part is the user data. It is the integration of all the information of end users on the Internet. How can we effectively integrate user-centric services from different enterprises or organizations? We need to sort out the entire services of user system. Many companies on the Internet, such as Baidu, Tencent, Ali, Jingdong, open their own user system. For example, a provider of cloud services for a specific industry is only required to provide a unique user account system (agreed with existing Internet account system) to enable the organic integration of services on a third-party Internet. As a result, during the process of cross-service integration the user service will generate user portrait which is actually the basic data exchange, or so-called data asset.

Why the user service or user service based on cloud services is the core asset of connecting all services on the Internet to form an ecosystem? Because many existing services have already had user systems and many user accounts do not need re-create. For example, users can use the WeChat account or QQ account as direct access to the data of other organizations and their various cloud services. Therefore, we need to package the user services so that it can be invoked and integrated by the new applications. User data is the most basic resource we need to build in any new value-added services. In
addition, with user behavior data, we can easily achieve precise marketing and provide accurate service.

In the concept of service ecosystem, the assets of user data are essential. Data settled down in other services will expand around the user portrait. With same account, user can achieve data sharing and dissemination in different applications. For example, using the Light Application "Action Flow" in the WeChat Official Account Platform, a dedicated cloud services technology, we can bring up the previously mentioned team “NCSC2015 Report”. The work such as data association, task assignment and data research, can be reproduced through the Light Application of WeChat. Undoubtedly, this work is not limited to project management; instead, it covers the promotion, marketing and other aspects. Accordingly, it can be recognized that the sharing of data between different applications and services is based on the sharing of user information and account system.

4. "INTERNET +" APPLICATION SCENARIOS

In the era of digital economy, a wide range of Internet information services can form a lot of service ecosystems via the data value chain. Subsequently, there are further questions of how to apply the service ecosystem to specific scenarios and support the national strategy "Internet +".

4.1 MARKETING

Marketing is the first link in the value chain of enterprises and organizations. Furthermore, marketing is closely related to our daily life. To obtain social sense of accomplishment and value creation, we must learn the marketing. Old-fashioned marketing methods may be too common in a lot of papers and journals. However, most people do not have time to study the printed monograph, on the contrary, people are more likely to be attracted by the reports and new achievements released on the Internet. Proactive marketing is like creating waves in a pool. After the waves, people may have the energy and interest to further observe the real things behind waves. Armed with this concept, we can build a cloud service product, specifically designed for various ideas of users so as to promote their ideas into action, and further to create value with such action. Moreover, much information of potential users can be collected by organizing various activities. Their interest in the work can be triggered. For example, when we organize activities, the work like the activity publicity and registration can be realized in the cloud, or on the mobile Internet.

4.2 CONFERENCE PLANNING

Another “Internet+” application scenario is conference planning. The organizers not only conduct the planning and management of meeting, but also promote the effectiveness of meetings and monitor the meetings. With the Internet, we can broadcast live presentations, let researchers absent participate in and promote the further dissemination, ultimately enhancing the influence of industry throughout the conference. Each of these processes can be done through an Internet service.

In May 2015, the 3rd China Big Data Industry Summit was held in Shenzhen. As a pilot activity of "Internet +" scenario applications, the whole process of summits were fully integrated with various Internet services. From the publicity to the registration, from live to afterward data analysis and follow-up, the whole process was deployed on mobile Internet platform. This cloud service looks like one solution required, but in fact, every link can be regarded as a separate service. For example, on-site interactive research requires feedback on the composition of the report, proportion of theory, practice and concept, thus the corresponding questionnaire is required. At this time, the use of "Internet +" means, the background can handle far more problems than the traditional manual approach and get a lot of feedbacks.

Another example is the election of members. There are 85 candidate members in the final election of CCF’s Big Data Committee. The information of the candidates would be sent to the 150 members of the existing Big Data Committee to vote. In the past, the traditional way of service was to appoint a professional secretary to e-mail each member. As a result, a secretary sent 150 documents to 150 members and then retrieved 150 messages, extracted and consolidated the information of each message. It was found that, in the process, with the service of the secretary, the data did disseminate, and the members were finally selected for new value. However, the efficiency of the whole job was very low: data
distribution and integration lacked a unified and efficient approach to be planned and processed in time and space. However, if cloud services technology is applied, the committee only needs to set the voting options in the cloud platform and wait for members to vote. Moreover, the secretary may take several days to figure out the result, but with the cloud platform, the results may come out in just a few minutes. In fact, the entire conference management solution used a number of cloud services, but they share the same data and the same user system.

If we want to share the conference report material through the cloud service, we can publish the material via "Action Flow" or spread it in the "loose-leaf" way. From the late June to the early July in 2015, the author participated in the ICWS meeting near Times Square in New York. The "loose-leaf" method was applied by the author to directly broadcast the PPT of IBM - "Cognitive Computing". This approach is almost real-time and delayed less than a minute. PPT presentation content can be generated on the WeChat as an article, modified and published at any time. Thus, service computing covers all aspects of the meeting, and helps each link achieve more value.

4.3 NEW BUSINESS MODE

We can take the fifth-generation HTML, namely, H5 as an example. If H5 becomes the standard format for some kind of presentation of "Internet + X", which means all services in the "X" domain use the H5 protocol interface and choose H5 as the language implementation. At this point, H5 is equivalent to the standard connector and renderer of service ecosystem in a particular domain. With the show and tools, it can be very easy to create a new business model even without one line of code.

A new business model, for example, is to let every employee in the company and everyone in the community becomes a headhunter to recommend talented people like large data engineers, architects and analysts. Everyone can quickly complete the headhunting recruitment of "fast exhibition" in the H5 platform. After the completion it can be shared in Moments of WeChat. In this aspect, if someone wants to recommend a suitable object, he or she just needs to click on the phone screen, fill the form in the micro message, select the post and submit the personal information. Then, the candidate information will automatically enter the system talent pool. If the person is hired by the company, the referrer will receive the referral bonus. Consequently, without even a single line of codes, a new business model will be able to achieve via the Internet's cloud services tool (H5), a service connector.

5. CONCLUSION

In the era of "Internet +", many resources, especially the computing resources, only shared as services, will produce value. When a variety of services provided by different vendors and organizations, they will form a complete set of service ecosystem. Only through the guidance of the data value chain theory can the service ecosystem be fully utilized and generate value in specific fields and industries. The traditional combination of services, service integration methods and ways of thinking will then change correspondingly.

To conclude, every organization and enterprise stepping into the era of "Internet +" will become a company armed with big data. Only by precipitating Internet data and aggregating external Internet data can enterprises make intelligent decision and analysis to support business development and create new business models. Therefore, the only way for the future development of enterprises is to take the data value chain as the core, integrate specific areas of Internet services, and ultimately form the field of service ecosystem.

6. REFERENCES


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