An Industry Policy Toward Cloud Service Brokerage

Sheng-Chi Chen

Shari S.C. Shang

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Sheng-Chi Chen, National Chengchi University, Taiwan, 102356503@nccu.edu.tw

Shari S.C. Shang, National Chengchi University, Taiwan, sshang@nccu.edu.tw

ABSTRACT

The development of the cloud computing industry re-shapes the global IT industry. Cloud computing technology and its service applications are taking off around the world. The governments around the world have gradually adopting cloud computing as the new way of public services provision, while industry partners have lack of confidence on adopting cloud-based solutions. The primary research question is how the national cloud computing strategy leads to design a mechanism to bridge providers and users in a flourishing industry. By using the action research method, this study proposes a cloud service brokerage mechanism as an intermediary of cloud service delivery. The contribution will present firms or policy makers an industry policy guideline for drawing up the cloud computing development strategy, which will shed light for future researches on cultivating an industry development scheme.

Keywords: Action research, cloud computing, cloud migration, cloud service brokerage

INTRODUCTION

With the evolution of information and communication technologies (ICT), cloud computing has been regarded as one of the crucial industries in Taiwan. As the era of cloud computing arrives, Taiwan government's endeavor to advance the application of cloud computing has gradually turned domestic information service providers' attentions to cloud computing markets. Developing cloud computing is a key policy for government and industry, while convenient service is an important issue for people living. In the beginning of 2010, the Taiwan Government has launched a "Cloud Computing Development Program", and has devoted to service planning and investment activities. At the end of 2012, in a three-year comprehensive review and suggestion adoption from public and private sectors, the Taiwan Government adjusted the policy and renamed as a "Cloud Computing Application and Development Program."

The main strategy of the national project is developing government clouds to attract investment and develop cloud solutions. The Ministry of Economic Affairs (MoEA) is responsible for cloud industry development and promotion, while the Council for Economic Planning and Development (CEPD, which now is reorganized as the National Development Council) is responsible for providing strategies of cloud application development. Simultaneously, the Cloud Computing Program Management Office (CCPMO) is organized to coordinate and manage the progress cloud program. The main functions of CCPMO are to link the cloud computing industry and government application services together, and carry out the inter-ministerial integration of services to businesses and the people as well as the use of government resources.

In recent years, firms have started to move their services into cloud computing environment, to seize the initiative and ensure future competitive advantages in the cloud computing market. However, firms in demand site are facing a generalized lack of understanding of cloud computing technologies and solutions and there is also a tendency to hold unrealistic expectations of what cloud computing can be expected to achieve. At the same time, firms in supply site are often dubious about their ability to develop cloud computing using existing products or services. The proliferation of cloud computing industry also extends the needs of service for cooperative cross cloud adoption. Firms as a provider not only need the user familiar with emerging cloud solutions, but also those can select adaptable service in the provision cloud service. There is thus an urgent need for policy makers to establish a service mechanism that will make it possible for providers and users to implement feasibility analysis before carrying out cloud migration, thereby helping to reduce cloud-based application development and deployment costs. This research attempts to discuss how the two cloud computing parties, supply and demand site, cooperatively lead to accelerate cloud migration of the ICT development in Taiwan.

RELATED WORKS

Cloud computing development

Building on the existing techniques including virtualization, distributed computing, utility computing, and networking techniques, individual and organizational users can lease computing resources through network with the pay-as-you-go pricing model [16][18]. According to the definition of the U.S. National Institute of Standards and Technology (NIST), cloud computing refers to a network-accessed computing resources pooling, including network, storage, application, and other computing service [9]. The service models of cloud computing can be distinguished into Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS), which have five essential characteristics, including on-demand self-service, broad network access, resource pooling, rapid elasticity, and measured service.

Gartner has defined cloud computing as "a style of computing where scalable and elastic IT capabilities are provided as a service to multiple customers using Internet technologies." [14] Another widely used definition of cloud computing is that adopted by the U.S. National Institute of Standards and Technology (NIST): "cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort or service provider interaction." [8]

Google and Amazon.com are the two leaders in the development of global cloud computing applications. They are based on the Internet and software services, starting out by providing software as a service (SaaS) and then scaling up their business with large-scale data centers to provide computing resources such as platform as a service (PaaS) and infrastructure as a service (IaaS). Major global players such as Microsoft, IBM, VMware, and Apple have also developed their own cloud computing services to further drive innovation into the emerging cloud applications [4].

Cloud computing policy in Taiwan
Cloud computing has been regarded as one of the crucial industries in Taiwan. In 2009, the Taiwanese government positioned cloud computing as a key strategic industry the development of which needed to be prioritized. In 2012, responding to changes in market demand and intensified international competition in terms of technology, etc., the overall strategic direction and objectives of the Cloud Computing Development Program were revised to emphasize value creation and production value, and the Program was renamed the Cloud Computing Application and Development Program; it was anticipated that, through the development of public-sector cloud computing applications, it would be possible to stimulate the continued development of Taiwan's cloud computing industry, while also planning the establishment of cloud open lab to serve as matching mechanisms for supply and demand [1]. In accordance with the development strategy, the Cloud Computing Program Management Office (CCPMO) shall assist vendors in participation of the government project to accelerate the development of the industry chain and launch e-government cloud services. However, not all vendors have the ability to participate in the government cloud applications build-up. At a time when the government and large corporations are working actively to deploy cloud solutions, there are also a growing number of small and medium enterprises (SMEs) that are in need of cloud computing services.

Cloud migration and cloud service brokerage
With regard to the practical aspects of corporate system moving to cloud and related market solutions, there have been many studies published on cloud computing adoption methods and on individual organizations' experience in this area. In the U.S., the Chief Information Officer has outlined a cloud computing development strategy for the U.S. Federal Government, to guide the adoption of cloud computing applications by Federal Government agencies; this strategy includes a cloud migration decision-making framework and case studies, covering cloud migration options, implementation, management procedures, and recommendations regarding flexible adjustment of adoption strategy in line with actual needs [15]. Different cloud migration processes need to be considered for different strategies. Zhao and Zhou make a comprehensive analysis of existing migration methods, and propose five migration strategies [20]. A systematic review of cloud migration studies gives a comprehensive analysis on research gaps identification and future research directions, but shows a lack of tool support in cloud migration. The research also concludes cloud migration is still in early stages of maturity [6].

Security Guidance for Critical Areas of Focus in Cloud Computing, published by the Cloud Security Alliance (CSA), provides detailed practical ideas and recommendations, and constitutes a first-class reference for organizations that are planning to adopt cloud-based services. Structured around 14 security domains in the 3 key areas of cloud architecture, cloud governance and operating in the cloud, Security Guidance examines the responsibilities of cloud-based service providers and service users, along with the potential security risks [2]. The governance framework of Microsoft's Azure cloud platform uses a policy management approach to ensure the usability, security and compliance of the cloud computing environment in terms of three key elements: design, implementation, and change management [8]. Oracle's Cloud Computing Maturity Model uses 8 Domains and 60 Capabilities to provide a reference procedure for the adoption of cloud computing by business enterprises [12]. Nasir and Niazi take the view that the concepts of cloud computing capabilities and experience have still not been properly defined, and they therefore propose a cloud adoption evaluation model based on a systematic review of the literature, which takes into account enterprises' motivation for adopting cloud-based services and their information needs; they use case studies to verify the usability of this model [9]. Xin and Levina note the many challenges that still exist in relation to cloud-based services, including uncertainty regarding technology and demand, the impact on the inner workings of organizations, the relative importance of cloud-based services to a firm's overall IT strategy, and system integration issues [18].

Currently, vendors or providers are working actively to plan and develop cloud computing applications and services. Whether in the case of virtualization technology or operational service management technology, etc., there is a generalized lack of understanding of cloud computing technologies and standards. In many cases, the term "cloud computing" is used to describe what are merely services provided based on existing corporate e-enablement infrastructure or websites, and there is also a tendency to hold unrealistic expectations of what cloud computing can be expected to achieve. At the same time, vendors are often dubious about their ability to develop cloud computing using existing products or services; they tend to assume that cloud computing adoption inevitably involves the allocation of substantial resources.

A large pool of cloud service brokers has surfaced in the ICT market. NIST defines a cloud broker as an entity that negotiates relationship between cloud providers and consumers. A cloud broker has three different types, including intermediation, aggregation, and arbitrage. Moreover, its functions may have business and technical support service for managing multiple cloud services. A mechanism, cloud service brokerage, provides services of consultancy, management and technology. It has functions in adopting the cloud, and helping them in managing and maintaining it [5] [12]. Cloud service brokerage is also

classified as aggregator, integrator, governance and customizer. As defined, cloud service brokerage with professional values is to serve by bridging the gap between providers and users [17].

There is thus an urgent need for the establishment of a mechanism that will make it possible for users and providers to know each service requirements before carrying out cloud migration, thereby helping to reduce cloud-based application development and deployment costs. The cloud service brokerage mechanism proposed in this study is intended to help solve the problems experienced by both service providers and users in relation to cloud computing development; the mechanism provides a channel for exchanging and matching between the supply and the demand side.

RESEARCH METHOD

Action research involves the use of qualitative methods to study the problems faced by real workers in actual work situations. With participation and involvement being used to bring about improvements, the research process is implemented through an ongoing, interactive cycle of action, reflection and evaluation; the first step is to identify problems where improvement could be made, and then to take action, and to implement continuous evaluation [7] [8].

The author serves as officers of the Cloud Computing Program Management Office (CCPMO) which is in charge of giving suggestions to the development of government clouds and Industry development. Therefore, informal conversations, discussions, and meetings also are added to the quality of data collected. The author participates in the actual process of policy formulation, using interviews and observation to collect comprehensive data, and interacting with related parties, to examine the process of promoting cloud computing industry development and the analysis of relevant problems, employing actual participation and continuing improvement to explore these issues.

RESEARCH DESIGN

Cloud Service brokerage mechanism

The study proposes a mechanism to provide a channel for cloud providers and users, each for supply site and demand site. Working from the perspective of industrial policy, this study seeks to establish a cloud computing industry service team that can be used to support communication between the supply side and demand side, while also developing the required capabilities from both an operational and technological viewpoint. The service provider (supply side) should possess a reasonably high level of technological capabilities, while the service user (demand side) should be clear about its current level of cloud computing adoption in its operational processes. Through the bridging and negotiation function provided by the cloud service brokerage, the service provider can deliver solutions to the user, while the user gives the provider useful feedback in regard to domain practice. At the same time, this cycle can help the cloud service brokerage to build up more experience in guidance provision, which will enable the brokerage to provide even better diagnostic services in future projects.

In the past, the supply side has generally had little opportunity to test the products and services that it develops; service providers have also had difficulty in securing business opportunities. At the same time, the demand side has tended to have an inadequate understanding of what solutions are available on the market, and has lacked confidence in its ability to use these solutions effectively. The establishment of the cloud service brokerage mechanism, in collaboration with government policy implementation, can provide a rapid, effective way of matching supply and demand, thereby fostering the development of industry as a whole.
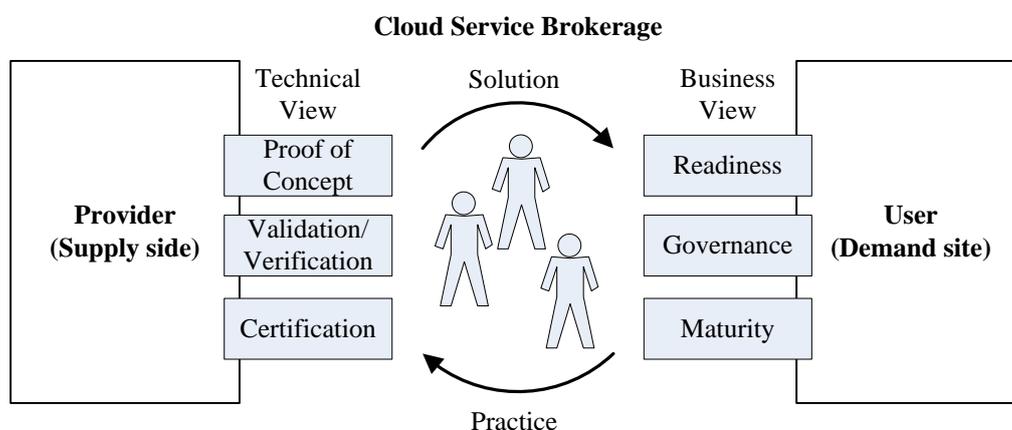

Figure 1. Cloud Service Brokerage Mechanism

Technical View

The technical view developed in this study has three functions: Proof-of-concept (POC), Validation/Verification, and

Certification. It will bring together a variety of different cloud-based solutions to reduce search costs for users; it will provide commercialization environment resources and testing opportunities so that firms can implement service feasibility testing in advance, thereby reducing unnecessary hardware procurement and development costs, and increasing the probability than any given development project will be a success. The main functions of the technical view description are as follows:

Table 1. Technical View Function

Function	Description
Proof-of-concept (POC)	Recruiting private-sector firms' existing cloud computing resources (supply side) to target particular cloud-based applications (demand side), providing matching and preliminary concept feasibility verification testing service.
Validation & Verification	Providing verification testing services for cloud-based applications (demand side) that verify the special features of these applications; providing verification testing services for cloud-based service level agreements (supply side) that verify conformity with openness criteria.
Certification	Providing certification and testing services, involving formal, signed documentation and/or marks or logos, in accordance with relevant cloud computing standards and rules.

Business View

In relation to the solutions already available on the market, there has already been considerable discussion regarding the methods that should be used for cloud computing adoption, and the issues to which attention should be paid when moving corporate services to the cloud, including organizational structure, business processes, compliance, service alteration, service levels, relationships with service providers, etc.

It is important for the user to be able to evaluate, from the business view, whether or not cloud computing adoption is suitable for their organization; understanding an enterprise's positioning (in terms of the level of cloud computing adoption) can help to overcome the problems that may be encountered in the process of switching over to cloud computing. It is therefore important that, when planning the adoption of cloud-based services, enterprises ensure that the relevant cloud computing inputs are compatible with the firm's strategic objectives. At the same time, pre-designed ongoing maintenance and monitoring mechanisms can help to reduce the latent risks accompanying cloud-based services, thereby enhancing organizational efficiency. With the model developed in this study, enterprises can choose to evaluate their level of cloud computing adoption in terms of readiness, governance, or maturity.

Table 2. Business View Function

Function	Description
Readiness (Uncloudified)	Readiness evaluates a firm's important indicators prior to cloud computing adoption, performed on the basis of three dimensions – technology, organization and environment – to determine whether the firm is suited for cloud computing adoption. The results are classified as: Good candidate, Candidate but concerns, and Not a good candidate.
Governance (Cloudifying)	Examination of the leadership, organizational structure and process aspects is used to verify whether cloud computing adoption can realize the organization's strategic goals and objectives. Evaluation of suitability is made, targeting enterprises that are already engaged in cloud computing adoption, on the basis of the analysis of four dimensions: organizational structure, enterprise processes, compliance and standards, and service quality.
Maturity (Cloudified)	The concept of maturity derives from the field of quality management, and is defined as the state of being complete, perfect or ready. Evaluation as to whether a firm has already successfully completed the process of cloud computing adoption is performed on the basis of analysis of five aspects: consolidation, integration, automation, self-service, and federation. The evaluation results can be presented in the form of a numerical score to indicate the level of maturity.

DISCUSSION

Cloud computing has become an important foundation for enabling thriving applications of ICT. The contribution for the cloud service brokerage model established in this study is to achieve effective linkage between industry supply and demand. From the demand-side perspective, the use of this channel can help to clarify the special characteristics of products. From the supply-side perspective, the channel will facilitate the provision of service involvement for cloud-based solutions that have already been developed, making it possible to achieve integrated usage of cloud-based solutions, and enhancing the overall level of synergy created from cloud-based products and services. The gradual implementation of these activities will help the supply and demand sides to achieve effective process planning for cloud-based product and services, thereby improving overall product quality and providing valuable supporting data.

This study will employ qualitative method, adopting case study to investigate the industry perspectives in Taiwan. By interviewing with 20 firms or associations, this study will explore how firms or associations take considerations to deal with the impacts which cloud computing brings about. The data collection puts emphases on both the providers (supply side) and

users (demand site) of cloud computing industry. The firms that provide or use cloud-related services will be invited to participate. The interviews, ranged from 2 to 3 hours, will be conducted. The interviewees, responsible for planning and designing the cloud-related service, products, or projects in their organizations, will be invited. For confidentiality, the name of companies, participants, and product information will be presented anonymously.

FUTURE STUDY

Cloud computing is becoming increasingly important for governments and enterprises. In this study, we provide preliminary thinking model of the industry policy and establishment of thloud service brokerage among users and providers. This study sheds light on the future works on industrial cloud computing promotion and implementation. Further researches can try to figure out the obstacles and enablers of industry policy development. Once cloud service brokerage has been widely adopted by industry associations and vendors, service level will become a major focus of discussion between service providers and users, with a need to reach effective consensus regarding pricing and service quality. The ability to compare service level across different cloud-based service providers and make choices based on this comparison will become increasingly important for organizations and firms that have a need for cloud-based services.

Finally, based on the techniques trends, cloud service brokerage will be an important role to accelerate cloud migration for both user and provider of cloud computing. How does the cloud service brokerage serving a channel enable an industry more cooperative and efficient is needed further works on it.

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