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A Mixed Approach of Negotiation in Internet of Things for cloud Envirnoment

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ABSTRACT:

Internet of Things (IoT) allows connected objects to communicate via the Internet. IoT can benefit from the unlimited capabilities and resources of cloud computing. Also, when coupled with IoT, cloud computing can in turn deal with real world things in a more distributed and dynamic manner. As the cloud market becomes more open and competitive, Quality of Service (QoS) will be more important. However, cloud providers and cloud consumers have different, and sometimes opposite, preferences. If such a conflict occurs, a Service Level Agreement (SLA) cannot be reached without negotiation. A tradeoff negotiation approach can outperform a concession approach in terms of utility, but may incur more failures if information is incomplete. To balance utility and success rate, we propose a mixed approach for cloud service negotiation, which is based on the "game of chicken." In particular, if one is uncertain about the strategy of its counterpart, it is best to mix concession and tradeoff strategies in negotiation. To evaluate the effectiveness of this approach, we conduct extensive simulations. Results show that a mixed negotiation approach can achieve a higher utility than a concession approach, while incurring fewer failures than a trade off approach.

Index Terms:
Cloud computing, Internet of Things (IoT), mixed negotiation approach, Quality of Service (QoS).

INTRODUCTION:

I NTERNET OF THINGS (IoT) is expected to be a worldwide network of interconnected objects [7]. IoT allows objects like computers, sensors, mobile phones, etc. to communicate via the Internet. It is characterized by limited capacities and constrained devices, and its development depends on new technologies including cloud computing. IoT can benefit from the unlimited capabilities and resources of cloud computing. Also, when coupled with IoT, cloud computing can in turn deal with real world things in a more distributed and dynamic manner. In this sense, IoT and cloud computing can complement each other.

Cloud services are Internet-based IT services. Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) are three representative examples.Compared with other models, cloud services are easier to access and use, cost-efficient, and environmentally sustainable. As theyeliminate large upfront expenses in hardware and expensive labor costs for maintenance, cloud services are beneficial to small- and medium-sized enterprises. Moreover, large-sized enterprises with computationally intensive tasks can obtain results quickly, since their applications can scale up promptly. As the cloud market becomes more open and competitive, Quality of Service (QoS) will be more important. However, cloud providers and cloud consumers have different and sometimes opposite preferences.

For example, a cloud consumer usually prefers a high reliability, whereas a cloud provider may only guarantee a less than maximum reliability in order to reduce costs and maximize profits. If such a conflict occurs, a Service Level Agreement (SLA) cannot be reached without negotiation. Automated negotiation occurs, when software agents negotiate on behalf of their human counterparts.

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It has been studied in electronic commerce and artificial intelligence for many years and is considered as the most flexible approach to procure products and services.

Existing System:

IoT allows connected objects to communicate via the Internet, whereas cloud computing promises unlimited resources delivered over the Internet . Zhou et al. review the state of the art of integrating IoT and cloud computing and propose a cloud-based IoT platform to facilitate things application development. In conducting service research, many ideas and methods have been proposed . QoS is important in discovering, selecting, and composing Web services , grid services and cloud services. Li et al. report that commercial cloud services are not yet stable and ask for more attention to the performance, reliability, scalability, and security issues of cloud services. Wang et al. argue that QoS and SLAs are increasingly emphasized in enterprise cloud services, and automated SLA and adaptive resource management are needed. Automated negotiation occurs when software agents negotiate on behalf of their human counterparts. It has been studied in artificial intelligence and electronic commerce for many years .Jennings et al. argue that negotiation is the most fundamental mechanism to manage runtime dependencies among agents, and thus underpins cooperation and coordination.Lomuscio et al. argue that automated negotiation underpins the next generation of electronic commerce systems, and develop a classification scheme for negotiation in electronic commerce. It offers a systematic basis on which different negotiation mechanisms can be compared and contrasted.

Proposed System:

Internet startups are able to reside on a cloud to build their services even without their own infrastructure. A storage cloud allows users to store their data in data centers without worrying about backup, such that they can focus on their core businesses Amazon Simple Storage Service (Amazon S3), Microsoft Windows Azure Blob Storage (Azure Blob), and Aliyun Open Storage Service (Aliyun OSS) are three well-known storage clouds . Here, we present a motivating example, where a StorageConsumer (SC) negotiates over QoS with a Storage Provider (SP). It contains conflicts that cannot be resolved without negotiation. Suppose that, five attributes, i.e., Availability (AVAL), Reliability (REL), Responsiveness (RESP), Security (SECY), and Elasticity (ELAS), are used to describe a storage cloud, as shown in Table I. The numbers are built upon our experiences with real-world storage clouds . Refer to for the definitions and the metrics of the five attributes. It is also shown in Table I that for the SC, availability is a higher-is-better attribute, for which a symbol is assigned beside its preferred values.

By contrast, for the SP, availability is a lower-is-better one, for which a symbol is assigned beside its preferred values. However, the two parties differ in their preferences over availability. The SP puts a weight of 0.20 on availability,whereas the SC places a weight of 0.10 on it. For conciseness, we list corresponding numbers for other attributes in Table I, without going into details.

MULTI-ATTRIBUTE BILATERAL NEGOTIATION:

Here, we introduce multi-attribute bilateral negotiations, with a focus on their negotiation protocol and negotiation strategies. In bilateral negotiations, two agents have a common interest in cooperation, but have conflicting interests regarding the particular way of doing so . In multi-attribute negotiations, multiple issues are negotiated among agents, where a win–win solution is possible.

However, a multi-attribute negotiation is more complex and challenging than a single-attribute one, because of complex preferences over multiple issues and the multiple-dimensional solution space. For multi-attribute bilateral negotiations, which we deal with in the paper, their negotiation protocol and negotiation strategies merit special attention .

Negotiation Protocol:

A negotiation protocol specifies the “rules of encounter” among agents . In this paper, we adopt an alternating-offers protocol for cloud service negotiation . In multi attribute bilateral negotiations, two agents alternately exchangetheir proposals and counter proposals, until one of them accepts a proposal, a failure to reach an agreement happens, or the deadline is reached. If the first case occurs, the negotiation ends successfully with an agreement established; otherwise, it fails and terminates with no deal made.

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Once the negotiation protocol is chosen, negotiation strategies become critical. Two negotiation strategies, concession and tradeoff , can be used to make a proposal. When the deadline approaches or something undesirable happens, a party has to concede in order to make a deal. With a concession strategy, the party gradually reduces its utility until all conflicts are resolved.

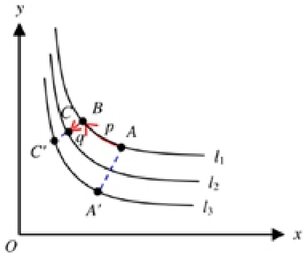

Fig. 1. Mixed negotiation approach.

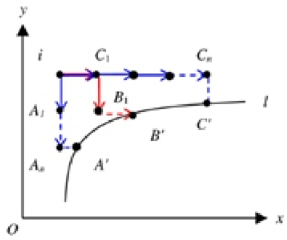

Fig. 2. Agent i's mixed behavior.

EVALUATION AND ANALYSIS:

We conduct extensive simulations to evaluate the mixed approach for cloud service negotiation. First, we describe the experimental setup. Next, we describe the parameter setup. Finally, we report and analyze simulation results.

A. Experimental Setup:

All simulations are conducted on a Lenovo Think Centre desktop with a 2.80-GHz Intel Pentium Dual-Core CPU and a 2.96-GB RAM, running Microsoft Windows 7 Professional Operating System. The simulations are implemented with Java under Net Beans IDE 7.2.1 with JDK 7u13. An alternating-offers protocol is adopted as the negotiation protocol, and a mixed negotiation strategy is compared with concession and tradeoff strategies. The negotiation process works as follows. First, without loss of generality, a SP sends its initial proposal to a SC. Next, if the proposal is accepted by the SC, negotiation ends successfully; otherwise, the SC uses either mixed, tradeoff, or concession negotiation approach to create a counter proposal.

After that, the SC sends back the counter proposal to the SP, and the negotiation process repeats. The process ends once a proposal or a counter proposal is accepted, and it fails if no proposal is acceptable to both parties.Java multithreading, which allows multiple tasks in a program to be executed concurrently, is the ideal technique to simulate the negotiation process. A thread is the flow of execution, from beginning to end, of a task. We model the behaviors of the SP and the SC as two threads. In particular, we use thread synchronization techniques to coordinate their behaviors, and a shared object to exchange their proposals and counter proposals.

CONCLUSION:

IoT and cloud computing complement each other. IoT can benefit from the unlimited capabilities and resources of cloud computing. Also, when coupled with IoT, cloud computing can in turn deal with real world things in a more distributed and dynamic manner. To succeed in a competitive market, cloud providers need to offer superior services that meet customers' expectations. However, cloud providers and cloud consumers have different and sometimes opposite QoS preferences. If such a conflict occurs, an agreement cannot be reached, without negotiation.

A tradeoff approach can outperform a concession one in terms of utility, but may incur more failures if information is incomplete. To balance utility and success rate, we propose a mixed approach for cloud service negotiation, which is based on the"game of chicken." In particular, if a party is uncertain about the strategy of its counterpart, it is best to mix concession and tradeoff strategies. In fact, it is a mixed strategy Nash equilibrium of a negotiation game with two pure strategies, which provides the theoretical basis for our approach.

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