

Chapter 12

Design and Implementation of Multi-Agent Online Auction Systems in Cloud Computing

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ABSTRACT

Due to the high maintenance cost of traditional online auction system, poor load balance ability and down problems occurring in the peak value of system access, this paper aims to propose a solution to transit from traditional online auction system to cloud computing to get higher work efficiency, lower expenditure and less energy cost. The GAE platform is used to deploy application of the overall framework of online auction system in cloud computing, including development environment as well as online auction system components, and software architecture. The online auction negotiation algorithms in cloud computing are also proposed. Based on these key technologies, the business processes of the online auction system in cloud computing is designed, including users' login system, starting an auction, bidding processes, online auction data storage, and logout system. The online auction system constructed on GAE platform with cloud computing resources and storage ability can reduce the pressure of terminal equipment, which is more robust than traditional online auction system facing users' changeable needs in the process of online auction.

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1. INTRODUCTION

Cloud computing is a model for enabling ubiquitous network access to a shared pool of configurable computing resources (Bruneo et al., 2013). It can provide users and enterprises with powerful capabilities to store and process their data in third-party data centers (Wang et al., 2010), relying on sharing of resources to achieve coherence and economies of scale (Marston et al., 2011). The foundation of cloud computing is the broader concept of converged infrastructure and shared service (Haghighat et al., 2015). With the development of the technology of cloud computing, it offers varying benefits and appears differently in regions across the world (Arinze et al., 2010). Many industry and social areas, such as education (Sultan et al., 2010), logistics (Schuldt et al., 2010), social network (Chard et al., 2010) and enterprise resources planning (Mezghani et al., 2014; Raihana et al., 2012), try to transit from traditional operation platform to the platform with cloud computing to get higher work efficiency, lower expenditure and less energy cost (Berl et al., 2010).

Auctions are used in many areas: electricity markets, airports takeoff and landing slots, exploitation rights of natural resources (e.g. oil-drilling), selling of collectibles, luxury and second-hand products, government procurement contracts, foreign exchange (Ockenfels et al., 2006). With the rapid growth of E-commerce, online auction has become an active business model. Online auctions represent a special class of negotiations with many applications in conducting e-business transactions (Fasli et al., 2007). It can provide a general solution to the problem of discrete resource allocation among selfish agents in a multi-agent system (Shoham et al., 2008). With the increase of the amount of user access, the amount of data generated by the online auction system becomes huge, and the data structure becomes very complex correspondingly (Gregg et al., 2008), which requires a new platform can provide a stable, sustainable and efficient service for users.

Traditionally, auctions were utilized for trading support in economic markets in offline as well as in online environments. With the development of information technology, it is generally known that online auction can offer a lot of advantages (Chang et al., 2010). As a result, many attempts of building online auctions system are made to achieve this target. Wurman et al. (1998) developed an online auction system framework that supported dynamic bargaining process, which applies the best matching model to clarify the transactional model for both sides. However, it failed to provide effective load balancing strategy when it faces sharp increase of the number of users. Trevathan et al. (2009) put forward the principle of online auction system, which imitated real online auction environment through the establishment of online auction server. Nevertheless, the details of online auction system transaction, especially the convention of auction protocol, was not described effectively in the paper. By studying the negotiation algorithm between auctioneers and bidders in online auction environment, Shoham et al. (2009) designed the best online auction mechanism for auctioneers and bidders. Based on the above strategies, Yu et al. (2008) built the system framework of online multi-attribute auction and presented the negotiation algorithm of online auction system according to the analysis of the agreement and bidding strategies. Bellifemine et al. (2007) designed and implemented online auction system with three-layer architecture based on Java server explorer, Java applets and Java reusable components. But some performance defects of downtime and a huge maintenance cost were existed with the increasing number of online auction participants.

With the rapid increase of the number of users, many problems appear in traditional online auction system, including high operating costs (Bapna et al., 2009), low efficiency (Deek L et al., 2011), and poor load balancing capability (Rauniar et al., 2009) etc. As the transition from E-commerce to cloud computing becomes an inevitable trend (Wang et al., 2011), cloud computing is gradually introduced

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