

# Chapter 7

## Trust Calculation Using Fuzzy Logic in Cloud Computing

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### ABSTRACT

*Cloud Computing is the latest rage in the world of technology. It has vast potential that can be tapped to the advantage of mankind. But there are some challenges which need to be resolved in order to fully utilise its potential. One of these challenges is trust evaluation. Since services are provided by service providers to clients, there has to be some notion of trust between them. This chapter first provides the basic introduction to cloud computing and fuzzy logic. On the basis of extensive literature survey, this chapter discusses trust and its need, in addition to use of fuzzy logic for the purpose of trust calculation in distributed environments and cloud computing till now. Trust calculation using fuzzy logic has been explained through the use of various models. At the end, the difficulties and applications of using fuzzy logic for trust evaluation are discussed along with research directions for future.*

### INTRODUCTION

Cloud Computing is emerging as a promising way to change the perception of technology as we have today. Zhang et al. (2010) have defined cloud computing as “a model for enabling 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.” It is based on the premise of “why buy

when you can rent”. In simple words, it provides the consumers or users with an opportunity to use the resources provided by another party on pay-per-use basis. That is, users don’t need to buy or install the hardware or software at their end. Instead they can use the services installed by another party and pay them as per their use. This results in reduction in the costs incurred by the users. While this arrangement has many benefits, it also has some drawbacks. One major question that arises is – which Cloud Service

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Provider (CSP) should a user choose? Or framed in another way – which Cloud Service Provider should a user trust?

The basic objectives of this chapter are:

- To describe the issue of trust evaluation in cloud computing.
- To understand the basics and importance of fuzzy logic.
- To describe various approaches for calculation of trust using fuzzy logic.
- To highlight latest happenings particularly in cloud computing.
- To identify the opportunities and challenges.
- To identify new research directions.

## **BACKGROUND**

### **Trust in Cloud Computing**

Trust can be defined as the extent to which one partner is willing to participate in a given action with another partner considering the risks and incentives involved (Ruohomaa and Kutvonen, 2005). Reputation is defined as a perception a partner creates through past actions about his intentions and norms (Mui et al., 2002). In the context of cloud computing, “trust” may mean the degree of faith a consumer or user has on the goodwill of a Cloud Service Provider. “Trust” may also mean the level of confidence a Cloud Service Provider has on its users. Taking this notion to a different level, “trust” can also mean the degree of belief a user has in the goodwill of other users of the same CSP. Another related concept to that of trust is reputation. Reputation of a CSP may be defined as the collective trust all the users have on that CSP based on their past interactions with it. Reputation can also be used as a measure of trust. A user may trust a CSP based on its reputation.

### **Need of Trust**

When users want to use a cloud service, they first search for the CSPs meeting their requirements. The next step is to assess the trustworthiness of the CSP which may be based on individual experience or reputation or both. Users while using any service need to be fully assured about the security of their data. The users’ apprehensions about the security of their data in cloud environment arise out of several factors. Some of them are:

- **Transfer of control:** Data, infrastructure, resources and applications are situated with the cloud provider and he is the one entrusted with the responsibility of managing users, access control, security policies and their enforcement. The user, therefore, relies on the provider for ensuring data security, confidentiality, integrity and availability.
- **Involvement of a third party:** Dealing with a third party always involves risks. The core issue regarding trust is the levels of trust. Many cloud computing providers trust their customers and implement security on the assumption that those inside the cloud are good and those outside are evil but what if those inside are evil?
- **Multi-tenancy:** A Cloud Service Provider typically has a number of clients/tenants. These tenants share a pool of resources and may have conflicting goals. The issue here is how to deal with the conflict of interests. Do the tenants get along each other nicely? If not, then how can we isolate them?

### **Categories of Trust Functions**

Following are the different categories of trust functions (Chakrabarti, 2007):

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