Fuzzy Logic In Cloud Computing

V. Prasath, Nithya Bharathan, Neetha N.P, N. Lakshmi, M.Nathiya

***Abstract*-In a world that sees new technological trends bloom and fade on almost a daily basis, one new trend promises more longevity. This trend is called mobile cloud computing, and it will change the way we use computer and the Internet. In this paper we introduce idea of improving accessibility of Cloud using if then concept of Fuzzy, we have tried to present a model for evaluating user's satisfaction in cloudcomputing. Therefore, a conceptual model has been constructed considering attributes to evaluate cloud computing user's satisfaction in an Internet Service Provider(ISP) companies in Iran. To avoid any ambiguities which are caused by linguistic methods, in this evaluation model wehave used Fuzzy Inference System (FIS).**

***Index term*-cloud computing,attributes, fuzzy inference system , user's satisfaction.**

1. INTRODUCTION

Cloud computing is an emerging commercial infrastructure and internet based cost-efficient computing paradigm in which information can be accessed from a web browser by customers for their requirement. It is a modality of computing characterized by on-demand availability of resources in a dynamic and scalable fashion, where the resource is used to represent infrastructure, platforms, software, services, or storage[3].

Cloud computing is a virtual pool of computing resources. It provides computing resources in the pool for users through internet. Integrated cloud computing is a whole dynamic computing system. It provides mandatory application program environment. It can deploy, allocate or reallocate computing resource dynamically and monitor the usage of resources at all time. Generally speaking cloud computing has a distributed system, to achieve the purpose of efficient use of the system. Thus the cloud computing trend allows the user to perform some application specific operation on their own digital asset. Programs built using this model will run across multiple platforms extracting information from each of them combining and delivering it in their own form to any device anywhere in the planet. The power of services offered by the cloud environment is unlimited and these web services are randomly scattered over different servers and accessing and scheduling them which is really a challenging task [14].

Cloud computing are typically classified into two types such as types of services offered and location of cloud. The services are broadly classified as Platform as a service (PaaS), Infrastructure as a service (IaaS) and Software as a service (SaaS), etc... Based on the location cloud computing can be classified into four types like private cloud, public cloud, hybrid cloud and community cloud[4].

II.ATTRIBUTES

A. Policy issues

Cloud computing raises a range of important policy issues, which include issues of Reliability and liability, Security, privacy, and anonymity, Access and usage restrictions [5].

1)Reliability And Liability:

Reliabilityis improved if multiple redundant sites are used, which makes well-designed cloud computing suitable for business continuity and disaster recovery [1] . Users will expect the cloud to be a reliable resource, especially if a cloud provider takes over the task of running [5].

2)Privacy And Anonymity:

Current cloud services pose an inherent challenge to data privacy, because they typically result in data being present in unencrypted form on a machine owned and operated by a different organization from the data owner [6]. Users will expect that the cloud provider will prevent unauthorized access to both data and code, and that sensitive data will remain private [5]. Some of the privacy issues are :

a) ***Lack Of User Control***

User-centric control seems incompatible with the cloud: as soon as a SaaS environment is used, the service provider becomes responsible for storage of data, in a way in which visibility and control is limited.

b) ***Unauthorized Secondary Usage :***

There is a risk (and perhaps even an expectation!) that data stored or processed in the cloud may be put to unauthorized uses. It is part of the standard business model of cloud computing that the service provider may gain revenue from authorized secondary uses of users' data, most commonly the targeting of advertisements.

c) ***Legal Uncertainty:***

Legal frameworks have been instrumental and key to the protection of users' personal and sensitive information. *I*n Europe there is national legislation based upon EU Directive, in US there is a patchwork of legislation according to sector, information and/or geographical area, and in many

other countries worldwide analogous frameworks apply [6].

d) ***Access and usage restrictions:***

Users will expect to be able to access and use the cloud where and when they wish without hindrance from the cloud provider or third parties, while their intellectual property rights are upheld, "mission-critical" applications and will expect clear delineation of liability if serious problems occur [5].

B. Security Issues:

Security could improve due to centralization of data, increased security-focused resources, etc., but concerns can persist about loss of control over certain sensitive data, and the lack of security for stored kernels. Security is often as good as or better than other traditional systems, in part because providers are able to devote resources to solving security issues that many customers cannot afford

1) ***Data location****:*

When you use the cloud, you probably won't know exactly where your data is hosted. In fact, you might not even know what country it will be stored in. Ask providers if they will commit to storing and processing data in specific jurisdictions, and whether they will make a contractual commitment to obey local privacy requirements on behalf of their customers, Gartner advises [5].

2) Unwanted Access:

There needs to be an appropriate level of access control within the cloud environment to protect the security of resources. Cloud computing may actually increase the risk of access to confidential information .

3) Isolation Failure:

Multi-tenancy raises a security concern that one consumer may influence the operations or access data of other tenants running on the same cloud[6]. Multi-tenancy is a highly essential issue in cloud systems, where the location of code and / or data is principally unknown and the same resource may be assigned to multiple users. This affects infrastructure resources as well as data / applications / services that are hosted on shared resources but need to be made available in multiple isolated instances [7].

4) ***Recovery:***

Even if you don't know where your data is, a cloud provider should tell you what will happen to your data and service in case of a disaster. "Any offering that does not replicate the data and application infrastructure across multiple sites is vulnerable to a total failure," Gartner says. Ask your provider if it has "the ability to do a complete restoration, and how long it will take" [5].

III.CLOUD DEPLOYMENT AND SERVICE MODELS

All cloud computing deployment model are proper subset of internet as a global network. These models are Public, Private, Hybrid and Community cloud. Public and private clouds have some common feature such as scalability and virtualized IT infrastructure but there is a difference in term of access to the cloud and their implementation. Public cloud is available for all users and organizations can use services provide by other company. In community clouds, some organizations having common need, share their resource and services [8].

Private: a cloud infrastructure operated solely for an organization, being accessible only within a private network and being managed by the organization or a third party (potentially off-premise)

Public: a publicly accessible cloud infrastructure

Community: a cloud infrastructure shared by several organizations with shared concerns

Hybrid: a composition of two or more clouds that remain separate but between which there can be data and application portability [6].

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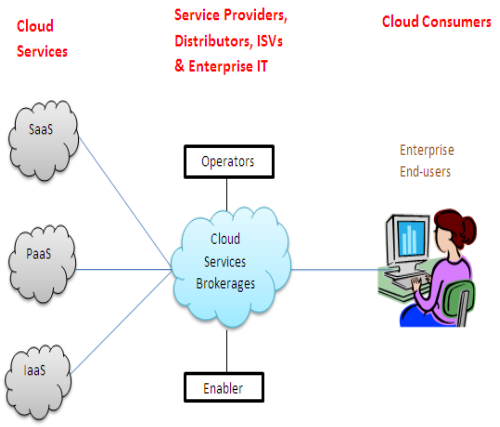

Fig: service architecture of cloud computing

A. Infrastructure As A Service (Iaas)

In such architectures, users can use the visualization resources as a fundamental infrastructure for their applications. These resources may be a CPU, network, or storage. Cloud users can manage the resources and assign rules for end users [10]. Services in IaaS are in low level and it is near to hardware. IaaS enables consumers to have more control over the IT

infrastructure. The famous suppliers in IaaS are Amazon and Go grid. Infrastructure as a service is a resource for computing, storage and communicating [8].

B. Platform As A Service (Paas)

In these architectures, users utilize all facilities on the cloud to develop and deliver their web application and services to the end users. PaaS services may include development, integration, testing or the storage resources to complete the life cycle of services [10].The delivery of a solution stack for software development including a runtime environment and life cycle management software. This allows customers to develop new applications using APIs deployed and configurable remotely. Examples include Google App Engine, Force.com and Microsoft Azure [6].

C. Software As A Service (Saas)

SaaS employs browser-initiated application software to serve thousands of cloud customers, who make no upfront investment in servers or software licensing. From the provider's perspective, costs are rather low compared with conventional application hosting. SaaS — as heavily pushed by Google, Microsoft, Sales-force.com, and so on — requires that data be protected from loss, distortion, or theft. Trans-actional security and copyright compliance are designed to protect all intellectual property rights at this level. Data encryption and coloring offer options for upholding data integrity and user privacy [11].

IV. FUZZY MODEL

The characteristic function of a crisp set assigns a value of either 1 or 0 to each individual in the universal set, thereby discriminating members and nonmembers of the crisp set under consideration. This function can be generalized such that the value assigned to the elements of the universal set fall within a specific range and indicate the membership grade of these elements in the set in question. Larger values denote higher degrees of set membership. Such a function is called a membership function and the set defined by it a fuzzy set. The range of values of membership functions is the unit interval [0, 1]. Here each membership function maps elements of a given universal set X, which is always a crisp set, into real numbersin [0, 1]. The membership function of a fuzzy set A is defined by A, A : X ----> [0, 1] [13].

A. Decision Making System

For decision-making, either type 1 fuzzy or type 2 fuzzy can be used as per the requirement. The four principal components of type 1 fuzzy decision-making systems are:

1) *TheInterface*: This determines the input and output variables and maps them intolinguistic variables that are to be displayed for the Cloud participants;

2) *TheKnowledge Base*: This is a part of expert systems that contains the domain knowledge. Membership functions, Group Key agreement and control rules are decided by the experts at this point, based on their knowledge of the system;

3) *The decision makinglogic*: This treats a fuzzy set as a fuzzy proposition. One fuzzy proposition can simply another, and two or more fuzzy propositions can be associated by a Boolean connectivity relation to infer a final fuzzy proposition;

4)The defuzzification interface converts the fuzzy output into a crisp value [12].

B. *Fuzzy Inference System*

Fuzzy set theory is a suitable system for modeling uncertainty arising from mental phenomena, which areneither random nor stochastic. In this paper, we use fuzzy inference system (FIS) to evaluate the cloud computing user's satisfaction A fuzzy inference system is a rule based system with concepts and operations associated with fuzzy set theory and fuzzy logic. This system is a rule based system which is mapping input spaces to output spaces. Therefore, they allow constructing structures to be used to generate responses (outputs) by certain simulations (inputs) based on the stored knowledge of how the responses and simulations are related. The knowledge is stored in the form of a rule base, that is, a set of rules that express the relation between inputs of a system and expected outputs [8]. A "membership function" is a curve that defines how the value of fuzzy variable is mapped in a degree of membership between 0-1.In this paper to evaluate cloud computing user's satisfaction three steps have been done. In step one, membership functions are used to calculate the degree of fuzzy user's satisfaction in different values expressed by linguistic term such as low, low to medium, medium, medium to high and high .

IF-THEN expression is the most common way for representing human knowledge. This form generally is referred to as deductive form. It means that if we accept on a fact (premise, hypothesis, antecedent), then we can infer another fact called conclusion (consequent). The fuzzy inference system is a popular way for wide range of science and engineering. In step two, for making rules the verbal options of experts regarding the effects of different factors such as security, efficiency and performance, adaptability and cost are gathered and processed for generating a rule base and using them as inputs of our fuzzy inference system [5].

C.Medical Diagnostics Using Cloud Computing with FuzzyLogic

Nowadays, technology is improving at incredible speed. People must be able to send their

symptoms by wireless networks or mobile cloud computing without geographical tyranny of moving to a hospital at initial stages of the disease. All we can do is to enjoy dabbling in the benefits that mobile technology brings into our lives by integrating cloud computing with medical diagnostics. Our sample diagnostic results from the trial data andmathematical modeling, therefore, seem to point to the

1) Disease1 predicted as d1 in patient p1 as 100% occurrence and 100% conformation probability from R1 and R2.
2) Disease2 predicted as d2 in patient p1 as 50% occurrence probability from R1 and 25% conformed from R2.
3) Disease1 predicted as d1 in patient p2 as 100% occurrence probability from R1 and 100% conformed from R2.
4) Disease2 predicted as d2 in patient p2 50% probable from R1 and 25% conformed from R2.
5) Disease1 predicted as d1, in patient p3 25% probable from R1 and 50% conformed from R2.
6) Disease2 predicted as d2, in patient p3 50% probable from R1 and 25% conformed from R2. Secondly we make an excluded sample diagnosis for a disease d in patient p if R3 μ (p, d) = 1.
7) Disease2 predicted as d2, in patient p1 100% not probable from R3and 100% not probable for p2. For patient p3 the disease d1 is 100% not probable from R3. Finally, we may include for patient p any disease d such that the inequality
R1 R2 .5 < max □μ (p, d), μ (p,d)□□ □is satisfied.
8) For patient p1 100 % probability of disease d1.
9) For patient p2 100 % probability of disease d1.
10) For patient p3 25 % probability of disease d2and d1 [2].

V.CONCLUSION

Now, mobile computing users are looking for more effective ways to store and access their large amount of personal data. Alternately complexity of managing data increasing so better solutions need to implement. Proposed work is providing more flexibility to access the data using if then rule of fuzzy concepts. Also that data may not be precise. In future proposed system may include fuzzy concept to improve accessibility of imprecise data also.

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