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# Towards Expert systems for Enhancing Quality of Service in Cloud Computing

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***Abstract:*** Cloud Computing is a technology that has accelerated the use of resources, internet, storage, server, services and their accessing mechanisms. It has provided globalization of these resources which can be accessed without personally acquiring them. It has presented a flexible technology which has reduces the cost, time and provided scopes for future technologies. It is a superset of all the technology that encircles the application and makes it available for other users.

***Keyword:***

## 1. INTRODUCTION

Today we are standing in the ocean of Technologies where every latest technology becomes outdated just the next day. Cloud computing is a term which has globalized these technologies in an effort to reduce the cost per user. Cloud computing aims to tie all the applications and put it on the roof of the world which can be accessed as per demand. It is just as the buffet system of serving meals. One can serve himself according to his taste and satisfaction. One problem that arises in this system is congestion due to high load. We can arrange every single technology that we need. All we need is an application that can make appropriate use of these resources and develop an application which provides us the desired technology. Cloud Computing is a term that make use of all the technical resources such as internet, computers, servers, database and create a centralized ware house such that every user can utilize it without investing extra time and cost. It finds application mostly in business and allows an entrepreneur to extend his business.

When we hear of the term cloud we imagine a large mass above us in the sky ready to shower water on us. The point in this is that we can neither own a cloud nor the rain. Cloud consists of all the technologies and we keep this technology in a centralized architecture so that anyone can use it. Everyone can access it and take use of the resources. It is hard to create a cloud for an individual. It finds its vast application in a large busine where you have hundreds of employees and a lar application. It is just like buying a large umbrella whic is covering the entire family.

*Figure 1.1*

## 2. NEED FOR CLOUD[1]:

Cloud computing is built for the world of tomorrow, where we each use many different kinds of computing devices: desktop, laptop, cell phone, or tablet. The intention is to make the functionality and data we need always accessible no matter where we are in the world, and no matter what we're using to access the Internet.

In addition, cloud computing is cheaper for businesses. If an online storage service is used, there's no need to buy server hardware, for example, or to pay for staff to maintain hardware.

Of course, there are some downsides. Putting data into the cloud involves a lot of trust that the cloud provider will not let it leak out. Cloud providers are a little coy when discussing issues such as this. Additionally, cloud services tend still at a primitive stage compared to equivalents on a desktop computer--Google Docs is only a fraction as powerful as Microsoft Office, for example.

Cloud Computing is an abstraction of technology, resources and their location. The key issues in Cloud Computing is networking , servers , Large storage space , Uninterrupted Connections , hardware to implement the applications and software which can act as an interface between the user and the application. The well known technology "INTERNET" provides a large network which covers the entire system in this world. The most sensitive part in Cloud Computing is Security and Handling of high congestion.

Security comes into consideration in a space where we share data and application. Security of data can be tightened when we hide the location of the data that has to be shared and we can keep changing the location of this shared data. This even covers security issues as well. It is based on PAY as YOU use technique. As everyone knows using a technology should not move out of the pocket. Clouds Computing has brought this technique as live and still more areas are there which are yet to be covered.

Cloud Computing starts with the application running under the system architecture. Applications are designed for a particular task. In Cloud Computing we make cloud full of application of similar functions performing their own functions. Each application in the cloud serves a different functions and offer different products for business and individuals. Under this roof we have a large space to collect the data required. We can have several users and each user have their own data. We need to have a large space which is in connection with each application so that user can access any application and store the required information. The storage space is provided to store data which cannot be accessed publically. It needs an authentication and only the particular user or the owner of the data has the access to the data. The complete data base has a unique key which identifies the particular user. User when ever gets in connection with the application he tries to retrieve his previous accessed data. Database keeps the track of all such details. Every user has his data saved in the database. Then is the need of sharing his data with other users in the cloud .Cloud computing vigorously uses INTERNET as the connecting media. All the applications running under this roof are connected to Internet. Users make full use of this technology in sharing data among each other. Cloud computing make use of INTERNET to maintain database and connect users.

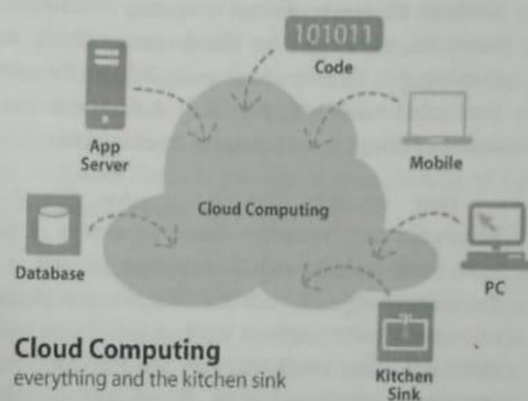


*Figure 2.1*

## 3. FEATURES OF THE CURRENT TECHNOLOGY RUNNING AS CLOUD COMPUTING [9] :

- It provides flexible, elastic and fast growing infrastructure.
- User need not to understand the complete technical details that is running under the application.
- It has high capability and can provide services to several users at the same instance.
- Provides space for each person which can be accessed personally.
- Provides security to the personal data.
- Gives an abstraction to the user of owning the complete structure.
- Highly scalable and self healing capacity.
- It allows the user to share personal data without worrying and compromising his security and privacy.
- It is independent of hardware.
- User has to pay only for the services he uses.
- Reduces accessing cost.

contracting requirements. As one respondent told us, "The problem with cloud services today is that many of the service providers have not evolved to the point that they are comfortable being custodians of data." That is, many providers have historical roots in product development, not service provision, so they often do not adequately understand what it means to have service liability.

In response, companies should evaluate cloud SLAs in relation to their company's risk management profile and the ecosystem of cloud providers. When the offered SLAs are insufficient, companies can seek to exploit multiple cloud providers for the same service. In this way they can fashion their own guaranteed uptime by creating virtual points of presence at extremely low cost. Also, companies can engage a service integrator to perform management and contractual functions.

### *4.4 Challenge #3: Dealing with lock-in*

Exit strategies and lock-in risks are key concerns for companies looking to exploit cloud computing. There is always a switching cost for any company receiving external services. However, cloud providers have a significant additional incentive to attempt to exploit lock-in. If computing were to become a very liquid commodity, and if switching to a lower-cost provider were too easy, margins would rapidly become razor thin.

When contracting for a cloud service, executives should be aware of two forms of lock-in. The first form, technology lock-in, concerns the cost of moving a business service from one cloud platform to another. Once a company is on a particular platform, it is often more cost-effective to purchase additional services compatible with existing ones—thus increasing lock-in. A second form, institutional lock-in, occurs when technologies become embedded within organizational routines and users' work practices. Particularly for users of software-as-a-service, such institutionalism can have a serious impact on the ability to switch cloud providers--which increases the severity of lock-in.

Providers are likely to focus on increasing lock-in as competition reduces margins. Competitors, however, will focus on reducing switching costs for dominant players. Specialist services and service integrators can help meet these challenges.

### *4.5 Challenge #4: Managing the cloud*

Although many dramatic predictions are being made about the impact of cloud computing—among them, the claim that traditional IT departments will become obsolete—our research supports the conclusion that cloud impacts are likely to be more gradual and less linear. Nevertheless, the cloud does carry with it significant disruption to business as usual, leading to two particular management challenges.

First, once introduced into the enterprise, cloud services can be easily updated or changed by business users without the direct involvement of the IT department. And it is in the provider's interests to develop functionality that expands usage and spreads it across the organization. So maintaining overall, strategic control of services can be difficult. This independence of the business when it comes to IT services also means that IT must work harder to gain the ongoing attention of the C-suite and to extend its strategic role.

Second, organizations are still slow in developing management capabilities and principles for operating with cloud services. Such strategies should focus on the multiple contracts needed for a cloud ecosystem. Effective supervision of usage, SLAs, performance, robustness and business dependency is vital. Monitoring the external provider's services must be done, but internal cloud monitoring should also be introduced. Support provided by cloud providers can be variable, and organizations should develop their own support services, either internally or with third parties.

## 5. TOWARDS EXPERT SYSTEM [13]

Expert Systems are computer programs that are derived from a branch of computer science research called *Artificial Intelligence* (AI). AI's scientific goal is to understand intelligence by building computer programs that exhibit intelligent behavior. It is concerned with the concepts and methods of symbolic inference, or reasoning, by a computer, and how the knowledge used to make those inferences will be represented inside the machine.

Of course, the term *intelligence* covers many cognitive skills, including the ability to solve problems, learn, and understand language; AI addresses all of those. But most progress to date in AI has been made in the area

## 4. CHALLENGES IN QUALITY OF SERVICE [12]

Is cloud computing the savior of business? Is it a threat to data security? Does it signal the demise of the corporate IT function entirely? These are some of the questions executives are asking about the use of remote servers in the cloud, which enables organizations to access on-demand computing capacity, software and business functionality.

Cloud computing is a young phenomenon, and it is suffering through the growing pains typical of its age. It's also subject to many overblown claims in the marketplace, from ardent supporters and detractors alike. Although the upside of cloud computing is considerable, numerous challenges lie ahead—among them, safeguarding data security and privacy, defining the contractual relationship with providers, dealing with lock-in and exit strategies, and managing the cloud services.

New research from the London School of Economics and Accenture—based on surveys of more than 1,000 business and IT executives, as well as in-depth interviews with more than 35 service providers and other stakeholders—takes a rigorous, data-driven look at cloud computing trends and usage. It is telling that the IT executives interviewed were almost uniformly more cautious about realistic timeframes for cloud implementation than were the business executives, who are especially interested in agile and cost-effective IT solutions in the near term. This caution is rooted in several implementation challenges.

### *4.1 Challenge #1: Safeguarding data security*

Our survey asked IT executives to identify the biggest risks in cloud computing. The top answer, named by two-thirds of respondents, was "data security and privacy." Potential adopters are concerned about the security of data outside the corporate firewall. A related issue has to do with offshore data housing, which can pose problems of legislative compliance when data crosses borders. In the short term, most companies can avoid these issues by using domestic cloud facilities.

The cloud carries some new risks, however—notably, as one of our interviewees put it, "People hack brands or hack applications regardless of what the infrastructure is underneath." Because a cloud provider hosts multiple clients, each can be affected by actions taken against any one of them, as in distributed denial-of-service attacks—server requests that inundate a provider from widely distributed computers. This is what happened, for example, in the wake of the WikiLeaks activities: when attacks came into the provider hosting WikiLeaks, all other clients were affected as well.

However, some of these risks are mitigated to a degree by new security applications such as encrypted file systems and data-loss prevention software. Cloud providers also have the ability to invest in more sophisticated security hardware and software, such as using analytics to examine unusual behavior across vast numbers of virtual servers. Beyond this, a provider's scale enables effective responses to large-scale server attacks through high levels of redundancy.

Concerned enterprises can also mitigate risk by employing hybrid clouds—a situation in which most servers are in the cloud, but key data is hosted internally—and by improving data governance.

### *4.3 Challenge #2: Managing the contractual relationship*

Cloud computing contracts are a mix of outsourcing, software and leasing. Some observers have argued that contracting for cloud is simpler than traditional approaches to IT sourcing because only one contract is required instead of multiple agreements for software, hardware and systems integration. In reality, however, few software, platform or infrastructure providers meet all of a client's functional requirements, so contracting for cloud services typically involves ecosystems of providers that must be integrated to provide complete solutions.

Cloud contracts generally focus on service-level agreement (SLA) guarantees, but the network of interactions within the overall ecosystem increases the complexity of SLAs. Software-as-a-service providers, for example, often share a single platform for all users, and so they cannot provide each client with a differentiated SLA. At present, relatively low compensation is offered by providers for breaches of SLAs, but competition should improve this situation, as should the development of cloud standards.

Our research also found that cloud providers are currently not adequately focused on providing enterprise of problem solving -- concepts and methods for building programs that *reason* about problems rather than calculate a solution.

AI programs that achieve expert-level competence in solving problems in task areas by bringing to bear a body of knowledge about specific tasks are called *knowledge-based* or *expert systems*. Often, the term expert systems is reserved for programs whose knowledge base contains the knowledge used by human experts, in contrast to knowledge gathered from textbooks or non-experts. More often than not, the two terms, expert systems (ES) and knowledge-based systems (KBS), are used synonymously. Taken together, they represent the most widespread type of AI application. The area of human intellectual endeavor to be captured in an expert system is called the *task domain*. *Task* refers to some goal-oriented, problem-solving activity. *Domain* refers to the area within which the task is being performed. Typical tasks are diagnosis, planning, scheduling, configuration and design.

Building an expert system is known as *knowledge engineering* and its practitioners are called *knowledge engineers*. The knowledge engineer must make sure that the computer has all the knowledge needed to solve a problem. The knowledge engineer must choose one or more forms in which to represent the required knowledge as symbol patterns in the memory of the computer -- that is, he (or she) must choose a *knowledge representation*. He must also ensure that the computer can use the knowledge efficiently by selecting from a handful of *reasoning methods*. The practice of knowledge engineering is described later.

## 6. THE BUILDING BLOCKS OF EXPERT SYSTEMS

Every expert system consists of two principal parts: the knowledge base; and the reasoning, or inference, engine.

The *knowledge base* of expert systems contains both factual and heuristic knowledge. *Factual knowledge* is that knowledge of the task domain that is widely shared, typically found in textbooks or journals, and commonly agreed upon by those knowledgeable in the particular field.

*Heuristic knowledge* is the less rigorous, more experiential, more judgmental knowledge of performance. In contrast to factual knowledge, heuristic knowledge is rarely discussed, and is largely individualistic. It is the knowledge of good practice, good judgment, and plausible reasoning in the field. It is the knowledge that underlies the "art of good guessing."

*Knowledge representation* formalizes and organizes the knowledge. One widely used representation is the *production rule*, or simply *rule*. A rule consists of an IF part and a THEN part (also called a *condition* and an *action*). The IF part lists a set of conditions in some logical combination. The piece of knowledge represented by the production rule is relevant to the line of reasoning being developed if the IF part of the rule is satisfied; consequently, the THEN part can be concluded, or its problem-solving action taken. Expert systems whose knowledge is represented in rule form are called *rule-based systems*.

Another widely used representation, called the *unit* (also known as *frame*, *schema*, or *list structure*) is based upon a more passive view of knowledge. The unit is an assemblage of associated symbolic knowledge about an entity to be represented. Typically, a unit consists of a list of properties of the entity and associated values for those properties.

Since every task domain consists of many entities that stand in various relations, the properties can also be used to specify relations, and the values of these properties are the names of other units that are linked according to the relations. One unit can also represent knowledge that is a "special case" of another unit, or some units can be "parts of" another unit.

The *problem-solving model*, or *paradigm*, organizes and controls the steps taken to solve the problem. One common but powerful paradigm involves chaining of IF-THEN rules to form a line of reasoning. If the chaining starts from a set of conditions and moves toward some conclusion, the method is called *forward chaining*. If the conclusion is known (for example, a goal to be achieved) but the path to that conclusion is not known, then reasoning backwards is called for, and the method is *backward chaining*. These problem-solving methods are built into program modules called *inference engines* or *inference procedures* that manipulate and use knowledge in the knowledge base to form a line of reasoning.

The *knowledge base* an expert uses is what he learned at school, from colleagues, and from years of experience. Presumably the more experience he has, the larger his store of knowledge. Knowledge allows him to interpret the information in his databases to advantage in diagnosis, design, and analysis.

Though an expert system consists primarily of a knowledge base and an inference engine, a couple of other features are worth mentioning: reasoning with uncertainty, and explanation of the line of reasoning.

Knowledge is almost always incomplete and uncertain. To deal with uncertain knowledge, a rule may have associated with it a *confidence factor* or a weight. The set of methods for using uncertain knowledge in combination with uncertain data in the reasoning process is called *reasoning with uncertainty*. An important subclass of methods for reasoning with uncertainty is called "fuzzy logic," and the systems that use them are known as "fuzzy systems."

Because an expert system uses uncertain or heuristic knowledge (as we humans do) its credibility is often in question (as is the case with humans). When an answer to a problem is questionable, we tend to want to know the rationale. If the rationale seems plausible, we tend to believe the answer. So it is with expert systems. Most expert systems have the ability to answer questions of the form: "Why is the answer X?" Explanations can be generated by tracing the line of reasoning used by the inference engine (Feigenbaum, McCorduck et al. 1988).

The most important ingredient in any expert system is knowledge. The power of expert systems resides in the specific, high-quality knowledge they contain about task domains. AI researchers will continue to explore and add to the current repertoire of knowledge representation and reasoning methods. But in knowledge resides the power. Because of the importance of knowledge in expert systems and because the current knowledge acquisition method is slow and tedious, much of the future of expert systems depends on breaking the knowledge acquisition bottleneck and in codifying and representing a large knowledge infrastructure.

## 7. IMPLEMENTATION

As we have already seen the challenges in cloud computing .The only way to overcome all the challenges is to implement expert system in Cloud computing or in other words we can say that we need to develop an expert cloud .We aim to improve the quality of Service. . Here are the four techniques that we have implemented .

1. Fuzzy Computing.
2. Evolutionary computing
3. Neural Computing
4. Probalistic computing.

1. **Fuzzy Computing** : In the real world there exists much fuzzy knowledge , i.e., that is knowledge which is vague , imprecise, uncertain , ambiguous , inexact or probalistic in nature .Human can use such information because the human thinking and reasoning frequently involve fuzzy information, possible originating from inherently inexact human concepts and matching of similar rather than identical experiences .We need a technology which not only answers like humans but also describe their reality levels. These levels needs to be calculated using imprecision and the uncertainty of facts and rules that were applied.
2. **Evolutionary Computing** [4]: Evolutionary Computing refers to a group of problem solving techniques which are based on biological evolution such as natural section and genetic inheritance . These techniques are randomly applied to a variety of problems, ranging from practical applications in the industry and commerce to leading edge scientific research.
3. **Neural Computing** [5]: aims to design and artificial brain which can manipulate the problems as a human brain do. It is a term which is used to investigate how biological nervous systems accomplish the goals of machine intelligence but while using radically different strategies, architectures and hardware and to investigate how artificial neural systems are designed that try to emulate some of those biological principles in the hope of capturing some of their performance.
4. **Probalistic Computing** [6] : is Based on or adapted to a theory of probability. It refers to a model where there are multiple possible outcomes, each having varying degrees or certainty or uncertainty of it's occurrence. It is directly associated with randomness.

## 8. METHODOLOGY

The technique which we would like to implement is to **encapsulate techniques of Expert Systems**. When we have a look to the basic structure of Cloud Computing it looks like:

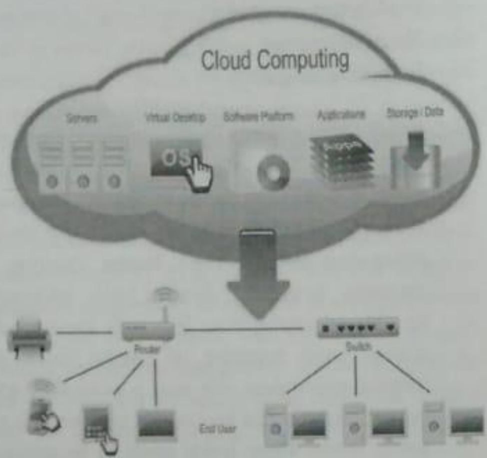


*Figure 4.1*

In this we find that we have all the applications in a single cloud which provides all sorts of services to the user.A user connects to the cloud using http ( Hyper Text Transfer Protocol )[7][8].http is used to build the network using logical links between the nodes. The request of the user is sent as a http command and reaches the server in the cloud. It follows client server protocol. The user sends the request in the form of http , and the server response to the request. As the cloud receives the request it maps the request from the data base and gives access to the user. It is a predefined technique. For a standalone cloud, an entrepreneur needs to have a large database where he needs to have all the data accordingly.

### *4.2 Importance and Relevancy*[10]

The technology now so called as latest is going to be outdated just the moment it's released. Before moving forward I would like to give a small introduction to what is technology. When we move around the technology, it is nothing without INTERNET. It is a string which ties the whole world. Computing is nothing without this network so called "Internet". Cloud Computing is often referred as as Internet Computing. There are various applications running in this world and no one would know it if there was no NETWORK. The technology that I am going to introduce to the world is surely is based on INTERNET. My small step is to implement the use of Expert Systems in Cloud computing. I would like to introduce a technology that can think of it"s own, can manage of it's own. If I request for something I would like the technology would work as if it were a human .I don't need any application I need a human .The research is still going on and will be moving further to get a technology which can work as a human. We can never have a human but can develop a brain which works as fast as the brain of human. My effort would be creating a brain which can work to think and manipulate the problems like a Friend which can fulfill all the demands of the consumer. I am here to implement the all four techniques of soft computing which can sort the problems of the whole world.

The first technology which is fuzzy computing. There are millions of brains and each brain thinks in a billion of ways .It's confused enough to make a choice. In human technology if a person thinks we call it "Sharpening of 'brain". But how can we sharpen the brain of a computer since we are the one whom have filled its database and also ordered the way to react. It can only work according to the command which has already been fed. Fuzzy technology is introduced to remove all the confusions and create a decision making technique .Research are still moving on and its vast area.

If we develop a brain, we would surely talk about neural network that can be used for connections between all the cells and communicate with each other and create a common thinking. Neural Computing deals with a technology in which brain cells and can communicate with each other. Neural computing is the technology that can think and implement and can even handle harsh situations .In an human being brain is the most important part that generates all sorts of feelings as happiness, harshness, lovable and so on and so forth, I have a question "Can there be a technology which can deliver feelings with expression. There is no limit to technology and my effort is to generate such a feeling full technology which works according to the situation.

We have seen many generations in this world and day by day every generation seems to be outdated to the next generations and the same follows with the current technology. But the generation only moves forward if we inherited the technology that has already been generated.

Yes, I am talking about the technology "Evolutionary Computing" which can inherit the computing which has already been introduce to the world and this can only happen if we teach the new generation about the technology that has been generated. Even if we don't teach here are many things which can be implemented that is so called born talent in Human beings. Evolutionary techniques cover all the parts which have already been introduced and give the world knowledge or a summary of the thing that has already been done.

When we talk about brains in computer we have to talk about chance as we know there is nothing fixed in this world .The brain of the user can request for anything and if there is a limitless demand we have to use the probability .The world of probabilistic computing is just to take a chance what would be the result. We have to take the consequences of all the outputs and define the technology accordingly.

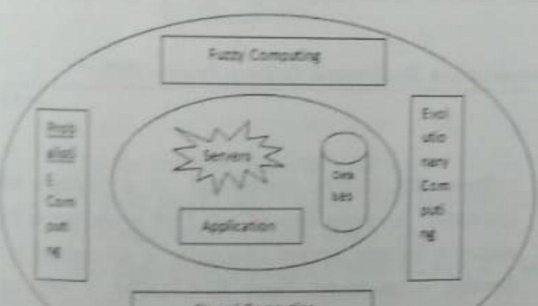


*Figure 4.2*

Our aim is to develop an intelligent Cloud which can work and can chose the services at its own without wasting time and extra cost. Often we have seen the user is not satisfied with the service and tries to switch from one server to the other and in every server he faces one or the other problems. There is no overall solution to the problem and user has to face the problem. This results in the loss of an Entrepreneur. We would work in sorting out this types of problems where are user need not to switch from one server to the other and can be given a proper choice .The other step which will be involved in this will be that there will be interconnections between the cl... can access the

currently .The current demand is to develop a computing or intelligent cloud which is as equal as a human being. Implementation of soft computing in a cloud computing seems to be an easier task to think on but has a vast problems to work on. This opens new arms for research. I would be presenting an architecture which would implement in our work.

## 9. CONCLUSION: RESOLVING THE TENSIONS

Our interviews have exposed potential tensions between enterprise executives, who express the desire for command and control over business services, and IT executives, who must adopt new modes of operation when it comes to leveraging the power of the cloud. Other tensions exist as well: for example, if cloud suppliers are looking to commoditize their services, how will clients achieve the customized services they desire to support business agility and differentiation?

These tensions are not insoluble, but they do suggest that providers and clients alike must consciously address a suite of cloud challenges in the planning, contracting and management of services.

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