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A CROMLECH EDITION OF CLOUD COMPUTING FRAMEWORK USING CONCEPT OF ONTOLOGY WITH QUERY RETRIEVAL AND REFINEMENT MECHANISM

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ABSTRACT

We all are living in the world of clouds. User has become adaptive to latest technology trends of information and communication technologies. Cloud computing has made our lives practical and keeps providing us services like consulting, data management and storage in efficient way. Cloud computing is one of emerging areas that is prevailing in industries at grandiose rate. It is combination of Internet and centralized network servers forming a mesh called CLOUD. In this paper, various aspects of cloud computing and its applications are presented. Some differences are provided between network models of cloud computing that are governing organizations and enterprisers. For achieving fault tolerance strategy, there is need to introduce multiple clouds and resource management architecture.

It is believed that existing model must be improved time to time to ensure efficient computing of tasks. The paper presents an improved version of cloud computing detailed architecture. It lists deficiencies between existing cloud information architecture and proposed ontology based architecture. Two additional modules have been introduced in model viz Query Retrieval and Query Refinement. Refinement of queries is done using Rocchio formula that extracts results based on relevance criteria i.e. by distinguishing relevant and non relevant results. They are introduced in order to get efficient indexed results after transforming user query.

KEYWORDS: Cloud computing, Deployment models, Query Retrieval and Refinement Mechanism.

I. INTRODUCTION

The concept of cloud computing was originated from telephony networking scheme. Before evolution of cloud computing, there used to be virtual networks that perform work of connecting multiple computers connected through base coaxial cable. This task is performed in 1990's. The use of virtual networks eliminated the hardware circuits between producers and consumers. It is compatible to use with varying network from time to time. But it did not work for long time in technology industry.

With advent of time and modern techniques of technology, it failed to cope with multiple work environments and producing multiple tasks due to decentralized environment. It did not provide services to multiple users at same time and failed to maintain interoperability with servers and clients.

It leads to evolution of cloud computing that works in distributive environments with multiple sources of information. Cloud computing is one of increasing trends in world of technology. It is given as name "dujour" says Gartner's Ben Pring [1]. It is big idea that will revolutionize the change in IT sector services. Although cloud computing effect is ruling minds of technologists, scientists and organizations but it is still occupied by some challenges as listed below:

Data Protection

Data Security is one of major element that needs to be taken care of. Cloud vendors fear of losing confidential and identity of their consumers. In cloud model, service providers are responsible for maintaining data security and enterprises have to believe them.

Data Recovery and Availability

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All applications are designed by considering some laws or rules that are called as Service level agreements (SLA's). There are teams designed to support data availability at anytime. These teams perform following tasks:

- Data Replication
- System monitoring
- Maintenance
- Recovery from failure

Management Capabilities

Although there are many multiple cloud providers, but management scale is not satisfactory. There is great need to improve on scalability and balancing features.

Regulatory and Compliance Standards

In most of developing countries, cloud computing is still in infancy stage. There are various standards that are not known to people and their effect of using them.

The paper is divided into following sections: Section 2 presents concise overview of cloud computing and its network models. Section 3 lists deficiencies in existing cloud computing open architecture and replaces it with proposed model. Section 4 concludes about given paper.

II. PROS OF CLOUD COMPUTING

Cloud computing is combination of various technologies like Grid computing, Virtualization, Autonomic computing, Ubiquitous computing, P2P computing and many more. Time to time updations in existing computer resources at various data centers is one of the factor that led to development of cloud computing.

Use of cloud computing is useful to users because:[2]

- It is inexpensive.
- It is convenient to use.
- Users can access data and use applications with the help of PC and Internet access.
- Software applications need not to be installed on computer; they can be directly accessible through Internet.
- Cloud computing produces applications to market very quickly by using most appropriate resources satisfying user needs.

Cloud computing performs services in ascending order i.e. we can use an acronym "ASC" which stands for Application, Storage and Connectivity.

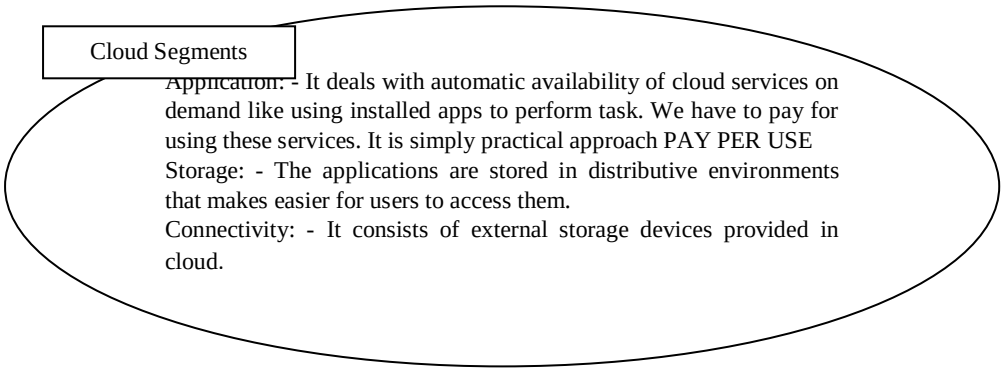

Fig 1: Features of Cloud Segments

Don't misunderstand between cloud computing and other parallel computing models like Grid computing, parallel computing and ubiquitous computing. Cloud computing is practical approach that performs task of professionalism by providing 24x7 services to users and charges them per usage.

Cloud Network Models

They are also referred to as cloud computing types- Public Cloud, Private Cloud and Hybrid Cloud.

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Public Clouds

They provide services to anyone globally with an Internet connection. They are owned by company which has its certain services. E.g. YouTube and yahoo are sites from which user access data in form of emails, attachments, videos from any device that has internet connection.

Private Cloud

They provide services privately and has private network to limited number of people using that network.

Hybrid Cloud

It is combination of both public and private cloud models. It has ability to add private cloud with resources of public cloud that helps to manage unexpected workload on cloud [3].

Architecture of Hybrid Cloud Management

It is developed by Doddle, Morsel and Smith. It has three interfaces- Query Interface of Amazon EC2, SOAP (Simple Object Access Protocol) of EC2 and REST (Representational State Transfer) interface of private cloud.

- Query interface of E2 uses a query string placed in cloud to implement management operations of resource manager. Amazon is cloud provider, provides list of defined parameters and their values to be included in query string. These query strings are sent by resource manager and HTTP GET messages are sent to URL's specified by cloud provider in order to perform management operations. In this way EC2 interface is mapped.
- SOAP is different from query interface in a way that it does not need actual parameters to perform each operation.

REST assigns uniform resource indicator (URI) to each local resource. Then resource is manipulated via HTTP and mapping is done as usual.

III. CLOUD COMPUTING ARCHITECTURE

Detailed View of Architecture

It is described in form of various modules defining their internal functions and components [4].

Cloud Value added services

It consists of five abstraction layers:

- *Physical Layer (Hardware as a Service)*:- It is bottom layer consisting of cloud providers, servers, operating systems, devices and switches. Customers of this layer are big industrialists who requires large amount of hardware as service. It performs data processing.

Use of cloud providers: - It provides information about hardware issues with help of remote scriptable boot loaders. These loaders allows cloud provider to specify the initial set of operations that are executed by servers during boot process.

- *Software Kernel*: - It is second layer and acts as interface between HaaS and Software infrastructure layer. Haas performs data processing whereas S/W infrastructure layer operates the hardware. This layer manages server's hardware resources and performs programs to run in parallel form. Implementation of S/W Kernel includes OS, Kernels, Hypervisors, Clustering and middleware. Hypervisors allows multiple operating systems to run on servers at same time. Clustering middleware is software located on group of servers which allows communication between multiple processes executing on different servers.
- *Software Infrastructure*: - It provides network resources to two layers namely: Software environment and Application layer above it. This layer leads to generation of new software environments and applications that will be delivered to end users in form of services. Services in this layer are as follows: Computational resources (IaaS) also called Infrastructure as a service. This is available to customers in form of virtual machines (VM). There are many virtualization techniques like para virtualization, hardware assisted virtualization, live migration etc that enables a single server to act as multiple virtual machines. Cloud provider offers computing resources to users without changing the physical infrastructure of data centers. IaaS allocates resources among various virtual servers. Examples of clouds that offer IaaS are Amazon elastic compute cloud (EC2), Reservoir architecture. Data Storage as a Service (DaaS) refer to stores data of users on servers located in remote locations. Users can access their information via web. Daas is evaluated on standards related to categories like Performance, scalability, relocatibility and accessibility. CaaS (communication as a service) provides communication

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that is reusable, schedulable, configurable and also encrypted. This communication enables CaaS to perform services like network security, real time adjustment to provide better bandwidth and network monitoring. Examples include VOIP (Voice over internet telephone), E-mail and Video conferencing

- *Software environment or PaaS (Platform as a service)*:- Users of this layer include cloud application developers who use applications to implement and distribute their resources via internet. Developers are provided with programming language and set of API's. Examples of S/W environments are GoogleApp engine and salesforce.com
- *Application Layer or SaaS (Software as a service)*:- This layer acts as an interface between cloud applications and end users to offer them in demand. It is so because cloud users run programs by utilizing the computational power of servers and it reduces hardware requirements of machines. In this layer, we don't have to install software on computers as all cloud software is located in providers' data centers.

Cloud IT Infrastructure Management and Cloud Core Infrastructure

Basically, this section comes under Infrastructure as a Service (IaaS) that consists of multiple Virtual machines linked to single server in various data centers. This module deals with management of hardware and software. Use of Virtual machines reduces the workload pressure on various cloud providers by following virtualization techniques like hardware virtualization, para-virtualization etc [5].

Cloud Information Architecture

The aim of this module is to represent cloud resources and information retrieved from large collection of web documents. For performing this task, the existing cloud computing model follows "GrepTheWeb" Architecture. It allows users to select documents according to their query. Large amount of results and document links are produced. These documents are treated as input and Grep architecture finds documents that match the user's query. It is compared with proposed model in next section of paper. The aim of this module is to represent cloud resources and information retrieved from large collection of web documents. For performing this task, the existing cloud computing model follows "GrepTheWeb" Architecture.

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Cloud Quality and Governance

This module deals with factors like Quality of Service (QoS), monitoring cloud models and updating them according to latest technology trends, defines model standards according to Service Level Agreements (SLA's). It deals with authentication and identity management of services accessed through cloud clients (web browsers, applications) to cloud users [6].

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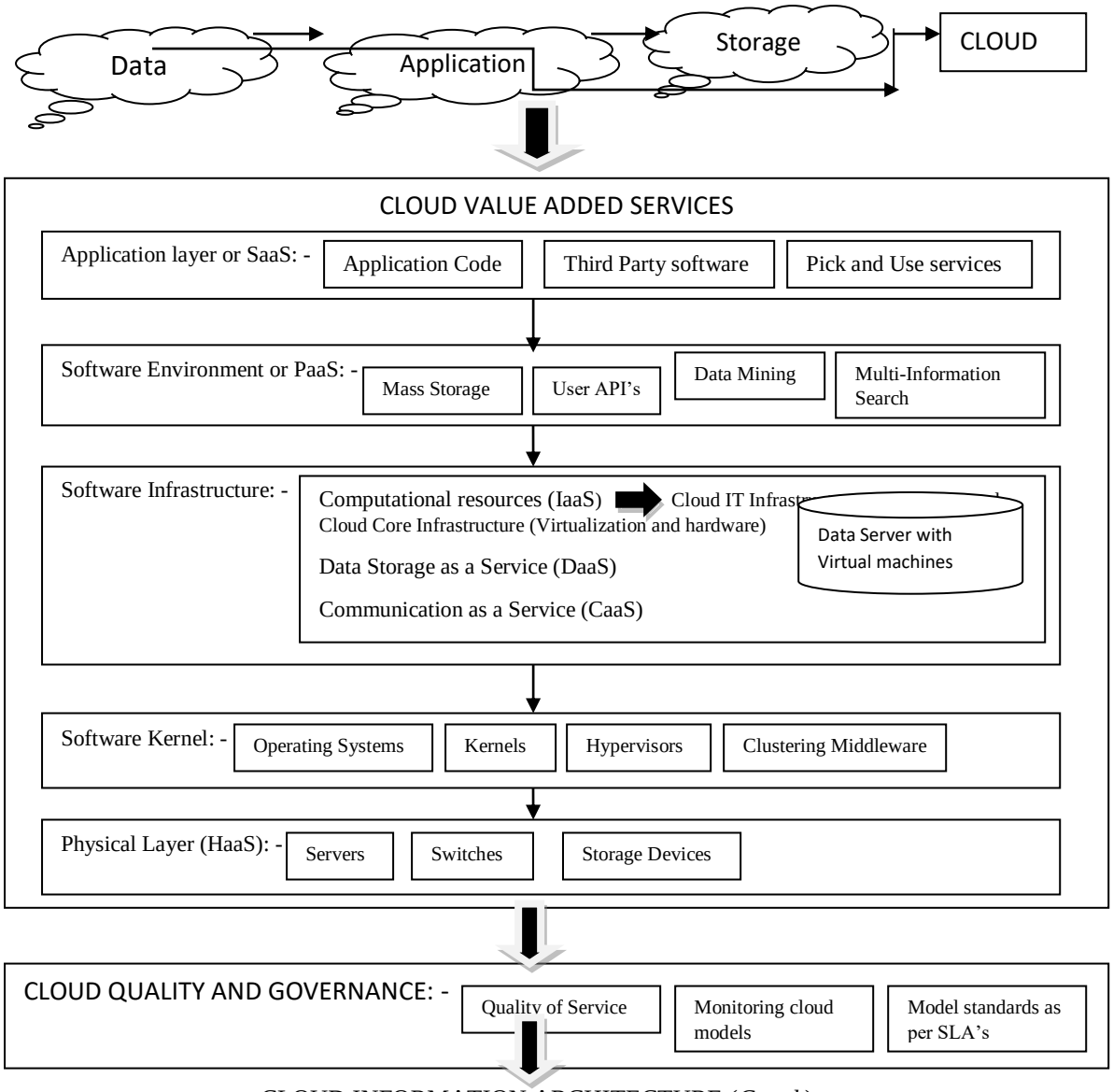
IV. PROPOSED CLOUD COMPUTING FRAMEWORK



CLOUD INFORMATION ARCHITECTURE (*Contd.*)

(Since Data Mining is performed in Platform Layer, so for efficient retrieval of information resources we have used concept of Ontology generation in cloud upcoming module)

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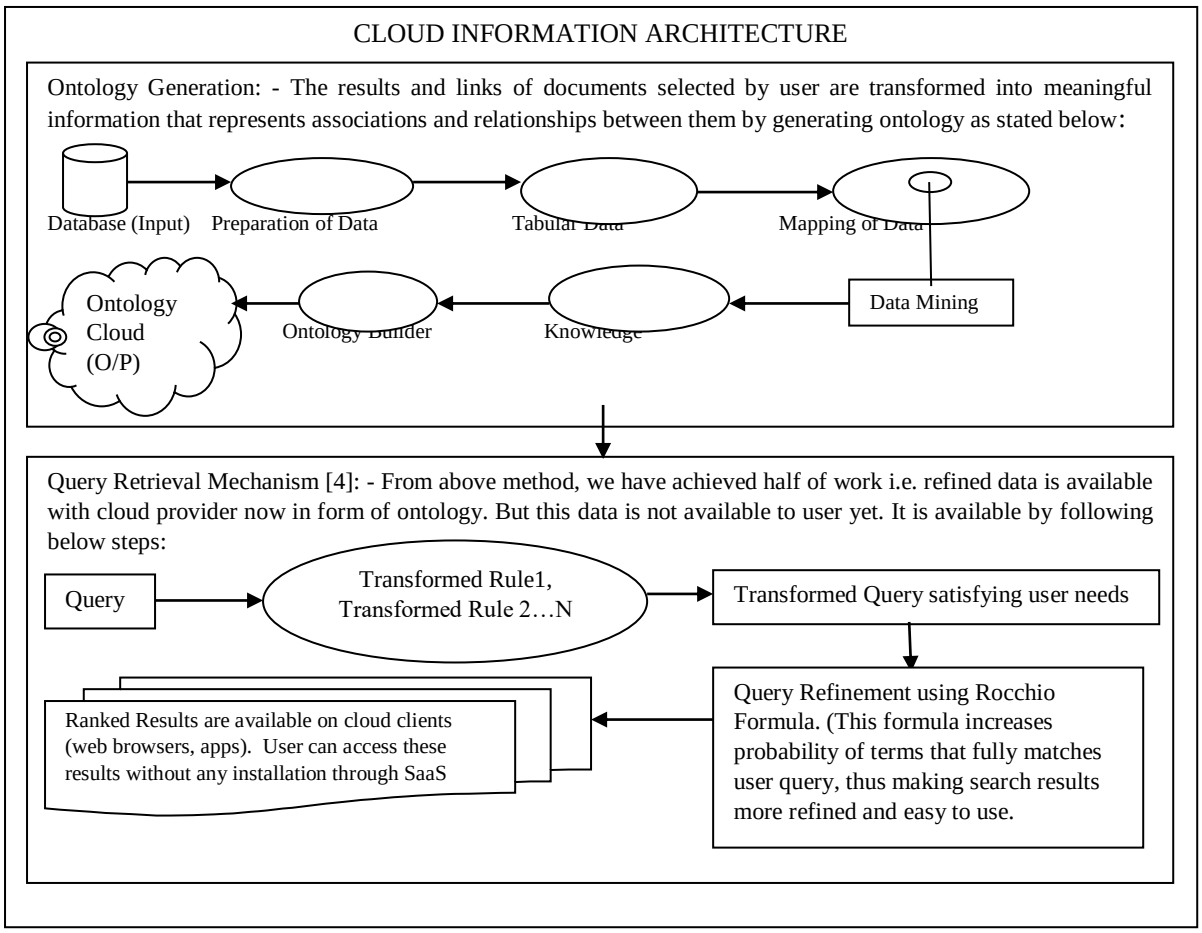

Fig 3: A Cromlech model of Cloud Computing Information Framework with enhancement of Query Retrieval and Refinement Mechanism.

V. WORKING OF QUERY RETRIEVAL MECHANISM

The given query is extracted in following manner as:[7]

- The query entered by user contains terms which may or may not be relevant. It is made relevant by use of Filters.
- Then filtered query process applies various ontology based rules to create a separate query which executes independently using full text search engine.
- After applying rules, we get transformed query corresponding to transformation.
- The query is executed and ranked results are produced on cloud clients (web browsers and applications).
- User can now access these results according to their limit.

Query Refinement using Rocchio Formula

Extracting relevant terms and documents from huge collection of search result links is cumbersome task. Although query retrieval process makes this task much easier but our aim is to make model more refined and scalable. It can be done by refinement of transformed query produced after applying generation of ontology and transformation rules. A tern can have different weights in each relevant document, so there is need to refine query. Query Refinement means calculation of old weights of expanded query terns in order to produce new weights of same query terns. These query terms are transformed into dummy document that is used for Indexing. Here is formula used that calculates new weights of query terms and produces optimal results by discarding non relevant terms. It is called Rocchio Formula.

Aim

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The aim of this formula is to increase weights of terms that occur in relevant documents and decrease the weights of terms occurring in non relevant documents.

Equation-

Q_a (new) = x * Q_a (old) + y * 1/ (RD) * $\sum wt_{aRD}$ – z * 1/ (NRD) * $\sum wt_{aNRD}$

Where Q_a (new) = New weight of query term a

Q_a (old) = old weights of tern s

RD = Relevant documents judged by user

NRD = Non- Relevant documents judged by user

wt_{aRD} = Weights of terms in relevant documents

wt_{aNRD} = Weights of terms in non relevant documents

$\sum wt_{aRD}$ = All weights of RD are added together

$\sum wt_{aNRD}$ = All weights of NRD are added together

y = It is constant that gives average of weights of terms in RD

If new weight is negative, then it will be discarded automatically.

VI. CONCLUSION

The paper presents pros and cons of cloud computing in world of information and technology. It describes cloud computing from infancy phase to developing phase. Its roots are still growing and occupying minds of various technologists and researchers. There are several models of cloud computing like Multi Source information architecture, security architecture, open architecture but none of them is able to provide any solution for refining of query terms extracted from web documents.

Its solution lies in concept of Ontology. It means to create relationships and associations between extracted documents so that user can easily identify those documents and use their services from cloud clients. Cloud providers provide these services as PAY PER USE. The proposed cloud information architecture deals with ontology generation module for unified representation of resources and messages stored on cloud clients. After accumulation of data at one place in cloud, it becomes easier for user to access data and services using Query retrieval mechanism. This mechanism filters results and refines them as relevant or non relevant. Unlike Grep architecture, proposed model also provides provision of reusing produces results for future use. It makes our search refined and efficient. Further improvements can be made in this proposed model.

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