Cloud Computing and Semantic web: An Interplay

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Abstract - Cloud Computing is internet based computing that provides shared computer processing resources and data to computers and other devices on demand. Semantic web is an extension of the current web in which information is given well-defined meaning, enabling computers and people to work in cooperation. This paper gives a brief picture of how Cloud computing and future web, semantic web technology evolved. However from the extensive literature survey, it is also observed that, these two technologies plays an interplay role with each other in solving complex problems. Furthermore an analysis of where semantic web technology meets cloud computing is carried out and briefly describes how Semantic web technology can be used to address the challenges of cloud computing.

Keywords: --- Cloud Computing, Semantic web, Technology.

I. INTRODUCTION

Cloud Computing is a new paradigm which provides automated delivering, elastic provisioning and scalability when addressing high volume requests from small, medium and large enterprises. [1] defines cloud computing as a model for enabling ubiquitous, on-demand access to a shared pool of configurable computing resources. There are several challenges to be addressed in cloud computing. Semantic web is the extension of the world wide web that enables people to share content beyond the boundaries of applications and websites. The main contribution of the paper is as follows.
2. An analysis of how web evolved into semantic web.
3. Describing the Scenario when the two technology met, Cloud Computing and Semantic web.

Section 2 describes in detail about cloud evolution, Section 3 explains about semantic web, Section 4 putsforth an analysis of how semantic web technology and cloud computing can be combined followed by conclusion.

2. CLOUD COMPUTING

This session discuss about how cloud computing evolved from different forms of computing. Further a description of service models and deployment models is illustrated.
A. Evolution of Cloud
   Personal Computing
   Mobile Computing

   Pervasive Computing
   Autonomic Computing
   Parallel Computing
   Super Computing
   Distributed Computing
   Cloud Computing

   Fig.1. Evolution of Cloud

Personal computing is defined as a computer built around a microprocessor for use by an individual as in an office or at home or school. The most popular use for personal computers was for connecting to the internet, playing games. Businesses use personal computers for word processing, accounting, desktop publishing, and for running spread sheet and database management applications.

Mobile computing is human–computer interaction by which a computer is expected to be transported during normal usage. Mobile computing involves mobile communication, mobile hardware, and mobile software. Communication issues include ad hoc and infrastructure networks as well as communication properties, protocols, data formats and concrete technologies. Hardware includes mobile devices or device components. Mobile
software deals with the characteristics and requirements of mobile applications

**Pervasive or Ubiquitous computing** is a concept where computing is made to appear everywhere and anywhere. In contrast to desktop computing, ubiquitous computing can occur using any device, in any location, and in any format. A user interacts with the computer, which can exist in many different forms, including laptop computers, tablets and terminals in everyday objects such as a fridge or a pair of glasses. Internet Of Things (IOT) would bring pervasive computing to more devices than what we know of today.

**Autonomic computing** refers to the self-managing characteristics of distributed computing resources, adapting to unpredictable changes while hiding intrinsic complexity to operators and users. The system makes decisions on its own, using high-level policies; it will constantly check and optimize its status and automatically adapt itself to changing conditions. An autonomic computing framework is composed of autonomic components (AC) interacting with each other. An AC can be modeled in terms of two main control loops (local and global) with sensors (for self-monitoring), effectors (for self-adjustment), knowledge and planner/adapter for exploiting policies based on self- and environment awareness.

Parallel computing is the concurrent use of multiple processors (CPUs) to do computational work. In traditional (serial) programming, a single processor executes program instructions in a step-by-step manner. Some operations, however, have multiple steps that do not have time dependencies and therefore can be separated into multiple tasks to be executed simultaneously.

**Supercomputing** is a general term for computing systems capable of sustaining high-performance computing applications that require a large number of processors, shared or distributed memory, and multiple disks.

- In distributed computing a program is split up into parts that run simultaneously on multiple computers communicating over a network
- Computation requirements are ever increasing
- Silicon based (sequential) architectures reaching their limits in processing capabilities (clock speed) as they are constrained by.

- Significant development in networking technology is paving a way for network-based cost-effective parallel computing.
- The parallel processing technology is mature and is being exploited commercially.

![Distributed Computing](image1)

**Fig.2 Distributed Computing models**

In a P2P system, every node acts as both a client and a server, providing part of the system resources. Peer machines are simply client computers connected to the Internet. All client machines act autonomously to join or leave the system freely. This implies that no master-slave relationship exists among the peers. No central coordination or no central database is needed. In other words, no peer machine has a global view of the entire P2P system.

![Peer to Peer Computing](image2)

**Fig.3 Peer to Peer Computing**

A cluster computing comprises a set of independent or stand-alone computers and a network interconnecting them. It works cooperatively together as a single integrated computing resource. A cluster is local in that all of its component subsystems are supervised within a single administrative domain, usually residing in a single room and managed as a single computer system. Design of utility computing is based on a service provisioning model, where users (consumers) pay providers for using computing power only when they need it.
need to. Utility computing focuses on a business model, by which customers receive computing resources from a paid service provider. All grid/cloud platforms are regarded as utility service providers.

Grid computing enables coordinated resource sharing and problem solving in dynamic, multi-institutional virtual organizations. Grid is often constructed across LAN, WAN, or Internet backbone networks at regional, national, or global scales. Enterprises or organizations present grids as integrated computing resources.

Cloud computing is a computing paradigm that involves outsourcing of computing resources with the capabilities of expendable resource scalability, on-demand provisioning with little or no up-front IT infrastructure investment costs.

Cloud makes possible for everyone to access the information from anywhere at anytime, unlike traditional computer setup, which requires the person to be in the same location as your data storage device[2].

3. SEMANTIC WEB

Web has evolved from file systems. Earlier Web had only static pages and hyperlinks. HTML static pages were taken off and later dynamic data becomes integrated into web pages. Web pages become interactive with the help of Javascript and Cookies. Evolution of web is depicted in the fig[5].

[3] states that the semantic web is an extension of the web through standards by the world wide web Consortium(W3C). The goal of the Semantic Web is to associate meaning with the data on the Web and to exploit the wealth of data on the Web through more intelligent (meaningful) processing[4].

The standards promote common data formats and exchange protocols on the web, most fundamentally the Resource Description Framework. Tim Berners-Lee is the creator of semantic web. He describes semantic as the most important concept of web 3.0. It is required to be more meaningful.

Semantic web stack consist of lower layers URI, Unicode, XML and middle layers consists of RDF, RDFS and RIF. The upper Layers includes Logic, Proof and trust which is not standardized yet.
4. CLOUD COMPUTING AND SEMANTIC WEB

Andreas Eberhart et al [7] analyses different ways in which cloud computing and semantic technologies can be combined. First one is scalability followed by rendering semantic technologies as services in the cloud. [7] also discusses about further improvement in automatic data center management. Hayet Brabra et al [8] discusses about how a semantic web technologies, holding a great potential to cloud computing can be used as a means to address the challenges related to interoperability, portability and security.

[9] analyses about how Resource description framework, semantic web technology can be utilized to build an efficient and scalable systems for cloud computing. [10] discusses about how the semantic web technology cloud will embed with the e-learning era with the help of cloud computing. Danish Manzoor et al [11] describes about how cloud computing is an evolution of web based internet application and its influence on E-Governance. [12] analyses how cloud computing on the background of semantic web will have an impact on the software engineering processes to develop quality software.

CONCLUSIONS

This paper gives a glimpse of how the two technologies Cloud Computing and semantic web evolved. Furthermore, it also discusses about the relation between the two technologies by illustrating where Cloud computing meets semantic web technology through a extensive literature survey. Future work may include a comprehension of the challenges in cloud computing and how semantic web technology can be used to address the issues incurred in recent Cloud services.

REFERENCES


