CLOUD INFRASTRUCTURE USING SOFTWARE AGENT –A REVIEW

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Abstract

Cloud computing provides virtualized resources and scalable infrastructure in the form of services over the Internet. It is a model for enabling on-demand network access to a shared pool of computing resources. Cloud infrastructure is implemented on virtual machines which are remotely located. Any user who wants to access his data or any application has to send request to cloud service provider who intern replies with an address or a pointer to the services. Agent-based Cloud computing must be set for providing agent-based solutions founded on the design and development of software agents for improving Cloud resources and service management , discovery and service composition. Autonomous agents can make Clouds smarter in the interaction with users and more efficient in allocating processing and storage to applications. In large-scale data centers, agents can search, filter, query and update the massive volumes of data that are stored. We study the architecture of agent based clouds using multi agent system.

Keywords: VMs, Cloud Computing, Agents, Saas, Paas, Iaas

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1. Introduction

Cloud computing provides dynamically scalable infrastructure or virtualized resources in the form of services over the Internet. It is a model for enabling scalable, on demand network access to a shared pool of configurable computing resources that can be provisioned ubiquitously and released with minimal management effort and cloud service provider interaction. Cloud computing paradigm uses virtualization approach to provide resources to the users on which they have full administrative control. Cloud infrastructure is implemented on VM's which are remotely located. Any user who wants to access his data or any application has to send request to cloud service provider who intern replies with an address or a pointer to the services. Existing cloud infrastructures use virtualization techniques with hypervisors to transparently allocate resources of physical hosts for a service provider's virtual machines (VMs). A key benefit of virtualization is that it allows running multiple operating systems on a single physical system where underlying hardware resources are shared.

2. Literature Review

According to Rajkumar Buvaya (2009), Agent-based Cloud computing is concerned with the design and development of software agents for bolstering Cloud service discovery, service negotiation and service composition. The significance of this work is introducing an agent-based paradigm for constructing software tools and testbeds for Cloud resource management. Novel contributions of this work include:1) developing Cloudle: an agent-based search engine for Cloud service discovery, 2) showing that agent-based negotiation mechanisms can be effectively adopted for bolstering Cloud service negotiation and Cloud commerce, and 3) showing that agent-based cooperative problem-solving techniques can be effectively adopted for automating Cloud service composition. Cloudle consists of a service discovery agent that consults Cloud ontology for determining the similarities between providers' service specifications and consumers' service requirements. To support Cloud commerce, this work devised a complex Cloud negotiation mechanism that supports parallel negotiation activities in interrelated markets.

Empirical results show that using such mechanism, agents achieved high utilities and high success rates in negotiating for Cloud resources. To automate Cloud service composition, agents adopt the contract net protocol (CNP) and use acquaintance networks (AN). Empirical results show that using CNP and AN, agents can successfully compose Cloud services by autonomously selecting services.

According to Rafel (2010), Cloud computing is gaining acceptance in many IT organizations, as an elastic, flexible and variable-cost way to deploy their service platforms using outsourced resources. Unlike traditional utilities where a single provider scheme is a common practice, the ubiquitous access to cloud resources easily enables the simultaneous use of different clouds. This paper explores the scenario to deploy a computing cluster on top of a multi-cloud infrastructure, for solving loosely-coupled Many-Task Computing (MTC) applications. In this way, the cluster nodes can be provisioned with resources from different clouds to improve the cost-effectiveness of the deployment, or to implement high-availability strategies.

According to Aarti Singh (2012), Cloud computing focuses on delivery of reliable, secure, fault tolerant, sustainable, and scalable infrastructures for hosting internet-based application services. These applications have different composition, configuration, and deployment requirements. Cloud service providers are willing to provide large scaled computing infrastructure at a cheap prices.

Quantifying the performance of scheduling and allocation policy on a Cloud infrastructure (hardware, software, services) for different application and service models under varying load, energy performance (power consumption, heat dissipation), and system size is an extremely challenging problem to tackle. This problem can be tackle with the help of mobile agents. Mobile agent being a process that can transport its state from one environment to another, with its data intact, and is capable of performing appropriately in the new environment. This work proposes an agent based framework for providing scalability in cloud computing environments supported with algorithms for searching another cloud when the approachable cloud becomes overloaded and for searching closest datacenters with least response time of virtual machine (VM).

According to Divya Jyothi(2012),In this paper secure dealer agent mechanism is implemented to provide market oriented approach by using cloud computing environment. Cloud by leveraging technologies, provides thought on market based resource management strategies that encompasses customer driven service management. The resources lie in a large stockpile in agent, from where it would be accessible to everyone. The Technology provided by the cloud for consider implement market oriented for providing services to the consumers. The services provided by the cloud computing to the providers pay for the services. Paper deals with ecommerce dealer agent mechanism transaction that enables business minded approach for the customers which is carried out from cloud computing. The main aim of the paper is to implement the mechanism such that the dealer is the actual ecommerce sites who will add its own product to the agent database. Agent is the one who will maintain all ecommerce sites product database and payment database. Agent searches the product in which ecommerce site the product is available. To start with web services enables the agent to service the product JAX-WS (web service) is used. Trading system is brought in a sense enabling trading. Direct payment is the default feature for buying product which then security concern is solved by PayPal sandbox implementation for secure transaction. The load impact performance of individual website is measured by using Load impact tool.

3. Cloud Computing Architecture

Architecture of cloud computing mainly comprises of four layers: Hardware, Infrastructure, Platform and Application. These four layers facilitate three different types of cloud services i.e. Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS). These layers are described in detail as follows

Figure1: Cloud Computing Environment

- **Software as a Service (SaaS):** This service allows the consumer to use desired softwares from the cloud infrastructure. SaaS is a model of software deployment whereby a provider licenses an application to customers as a service for on demand usage. The software applications are accessible from various client devices through a thin client interface such as a web browser (e.g., web-based email). The consumers has no need to manage or control the cloud infrastructure including network, servers, operating systems, storage, or even individual application capabilities, with the possible exception of limited user-specific application configuration settings. SaaS therefore alleviates the customer's burden of software maintenance, reduces the expense and improves the operational efficiency of software purchases by on-demand pricing. One example of SaaS is the Salesforce.com CRM (Customer Relationship Management) application.

- **Platform as a Service (PaaS):** This layer is responsible for providing resources such as Operating System and software development frameworks. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and hosting environment configurations. Major purpose of PaaS is the delivery of a computing platform and solution stack as a service. It facilitates the deployment of applications without the cost and complexity of buying and managing the underlying software layers. It provides the facilities required to support the complete lifecycle of building and delivering web applications and services. An example of this would be GoogleApps and Microsoft Azure. This layer lies above IaaS on the stack and abstracts away everything up to OS, middleware, etc. This offers an integrated set of development environment that a developer can tap to build their applications without having any clue about what is going on underneath the service. It offers developers a service that provides a complete software development lifecycle management, from planning to designing and building applications to their deployment, testing and maintenance.

- **Infrastructure as a Service (IaaS):** This layer provides the consumers with processing facility in the form of virtual machines (VMs), storage blocks, networking and other fundamental computing resources so that the consumer may deploy and run arbitrary softwares, including operating systems and applications. The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems; storage, deployed applications, and possibly limited control of select networking components (e.g., host firewalls). IaaS completely changes the way of developers deploy applications. Instead of spending large funds on their own data centers, hosting companies or co-location services and then hiring operations staff to get it going, they can just go to Amazon Web Services EC2(Elastic Compute Cloud)4or one of the other IaaS providers, get a virtual server running in minutes and pay only for the resources they use. With cloud brokers like Rightscale, enStratus, etc., they could easily grow big without worrying about things like scaling and additional security. In short, IaaS and other associated services have enabled startups and other businesses focus on their core competencies without worrying much about the installation and management of infrastructure. IaaS is the delivery of computer infrastructure (typically a platform virtualization environment (Xen) as a service. Rather than purchasing servers, software, space for data center or network equipments, clients instead buy those resources as a fully outsourced service.

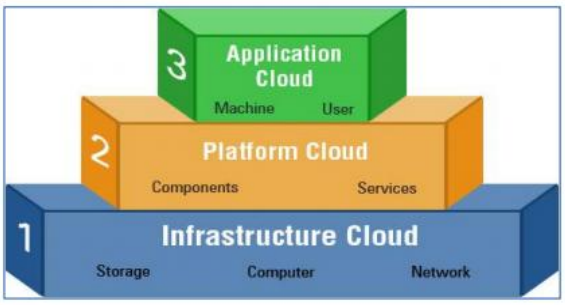

Figure2: Cloud Service Model

4. Cloud Deployment Models

About five years ago, when the first Cloud infrastructure has been deployed by Amazon, the online bookseller company that took the decision to start a new business selling computing

resources to companies and private users, the only deployment model was the Public Cloud one. It is a pay-per-use IaaS Cloud infrastructure that is owned by an organization selling Cloud services to the general public or to enterprises. Thus, it is public because it can be rent by anyone for developing and/or running any kind of applications. To use Amazon services, users must provide a credit card account and can spend from few cents to thousands or millions of dollars depending on the number of used resources and the usage time. After this early Cloud version, other deployment models different from Public Clouds have been designed and implemented

- **Public:** available publicly - any organisation may subscribe
- **Private:** The Cloud infrastructure is owned or leased by a single organization and is operated only for that organization. No public access to it is permitted. This model can be used in case of strict data privacy and/or security requirements.
- **Partner or Community:** The Cloud infrastructure is shared by a limited number of organizations and supports a specific community that has shared concerns (e.g., goals, security requirements, policy, and compliance issues).

4.1 Cloud Computing Benefits

The benefits of deploying applications using cloud computing include reducing run time and response time, minimizing the risk of deploying physical infrastructure, lowering the cost of entry, and increasing the pace of innovation.

1. Reduce run time and response time
2. Minimize infrastructure risk
3. Lower cost of entry
4. Increased pace of innovation

5. Agents in Cloud Computing

An agent is a computational entity that acts on behalf of another entity (or entities) to perform a task or achieve a given goal. Agent systems are self-contained software programs embodying domain knowledge and having ability to behave with a specific degree of independence to carry out actions needed to achieve specified goals. They are designed to operate in a dynamically changing environment. Agents typically include a set of features.

- Autonomy: the capacity to act autonomously to some degree on behalf of users or other programs also by modifying the way in which they achieve their objectives.
- Pro-activity*:* the capacity to pursue their own individual set goals, including by making decisions as result of internal decisions.
- Re-activity*:* the capacity to react to external events and stimuli and consequently adapt their behavior and make decisions to carry out their tasks.
- Communication and Cooperation: the capacity to interact and communicate with other agents (in multiple agent systems), to exchange information, receive instructions and give responses and cooperate to fulfill their own goals.
- Negotiation: the capability to carry out organized conversations to achieve a degree of cooperation with other agents.
- Learning: the ability to improve performance and decision making over time when interacting with the external environment.

Although a single agent can act and run to perform a given task, the agent paradigm was conceived as a distributed computing model where a set of agents interact one another by exchanging information and cooperating to perform complex tasks where interaction, intelligence, adaptation and dynamicity are key issues to be handled.

.1 Cloud Environment using Software agents

Cloud environment is considered to have three components clients, cloud service providers and Software agent. Now each component is explained below:

1. **Client** is the one who initiate request i.e. fulfilled by cloud service provider server. So that client never knows what is happening behind cloud environment.
2. **Cloud Service Provider** is a collection of System's (Servers) connected to each other that are running all time for full filling the client requests.
3. **Software agents** working on our and operating systems behalf, to provide intelligent data access services, monitoring services, processor-to-application assignment strategies, and energy-efficient use of Cloud computing infrastructures.

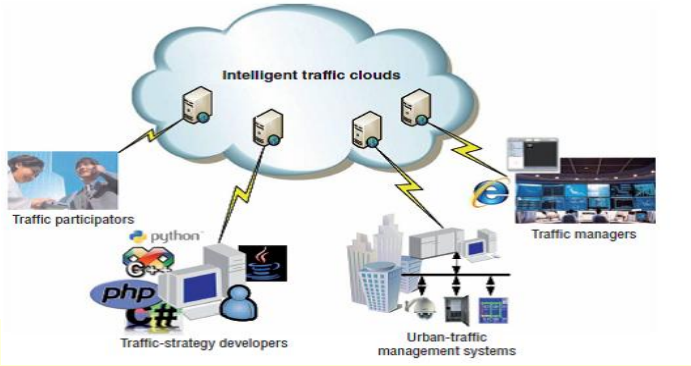

Figure3: Cloud Service Model using Agents

6. Clouds Using Agents

Cloud computing is a novel technology that has been designed and implemented in the past few years, mainly due to industry that was looking to a large-scale scalable computing infrastructure for implementing and selling service-oriented commercial solutions. Whereas much of the current effort on Cloud computing was devoted to the production of Cloud infrastructures and technologies for supporting virtualization and data centers, little attention has been devoted to introduce innovative methods for users and developers to discover, request, assemble and use Cloud computing resources.

A new discipline, called agent-based Cloud computing must be set for providing agent-based solutions founded on the design and development of software agents for improving Cloud resources and service management and discovery, SLA negotiation, and service composition. Autonomous agents can make Clouds smarter in the interaction with users and more efficient in allocating processing and storage to applications.

In large-scale data centers, agents can search, filter, query and update the massive volumes of data that are stored. We can envision a scenario where Cloud agents working on our and operating systems behalf, to provide intelligent data access services, monitoring services, processor-to-application assignment strategies, and energy-efficient use of Cloud computing infrastructures.

Research activities must be carried out to implement effective agent-based solutions for Cloud computing. This work should be done towards the three different *-as-a-Service delivery classes.

- In IaaS infrastructures, agents can be used to help the intelligent provisioning of basic resources to user applications,
- In Paas infrastructures, agent can play a role in the efficient deployment and execution of programming environments that developers use for application implementation.
- Finally, in SaaS Cloud infrastructures, agents can be programmed to optimize the use of applications provided as services and the management of the underlying hardware/software infrastructure taking care of its efficient utilization and, at the same time, for maintaining the declared QoS.

In Clouds, there also is the need to design and implement techniques and methodologies that adapt to the dynamic behaviors of Cloud computing environments. Autonomic techniques may help providers and users to reach this goal. Multi-agent systems that are able to handle with changing configurations, heterogeneity, and volatility, can provide a promising approach for addressing this requirement. Last but not least, security and trust are two very critical issues in Cloud computing as data and software are stored, accessed and run on machines that are not owned or directly managed by owners of data and software. Agent-based models and algorithms for trust and security in Cloud infrastructures could be very useful.

In summary, if agent-based solutions will be introduced in the software infrastructure of Clouds we will have:

- Intelligent and flexible Cloud services,
- Autonomous and pro-active services,
- Autonomic Clouds.

7. Conclusion

This paper discusses the agent based cloud computing using Agents. The main goal is to continuously supervising the system's in a cloud infrastructure so that if any of the systems fails to fulfill the request so that Software agent will redirect that request to some other system in a cloud so that client gets its requested information. The agent is active all the time so that it can perform task intelligently.

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