ISSN: 2277-9655
(I2OR), Publication Impact Factor: 3.785

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

REQUIREMENT BASED COMPATIBLE COMPOSITION OF VIRTUAL SERVICES FROM MULTIPLE CLOUDS

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ABSTRACT

Cloud is not an upcoming technology anymore. It's a well-established and booming technology in industry now. Almost every IT or non IT firm now want to get rid of their datacentre's responsibilities and shifting it to cloud. So they are hiring services from cloud. It may be a single cloud or multiple clouds to give services to the user. This paper provides a framework where user or customer is hiring services from different cloud vendors and we want those services to be compatible to each other as well as to the pre-existing environment of customer along with that it should fulfil the user requirements
e. g. minimum deployment time, minimum cost and maximum Reliability. This paper also penlights different concerns while hiring services from cloud vendors. As virtualization is a necessary tool while deploying cloud, all services are virtual services from cloud service provider. So, virtualization also plays a vital role while distributing services.

KEYWORDS: Cloud, Virtual Services, Compatibility, Requirements.

KEY TECHNOLOGIES

Cloud

Cloud computing grew out of the concept of utility computing. Utility computing is the belief that computing resources and hardware would become a commodity to the point that companies would purchase computing resources from a central pool and pay only for the amount of CPU cycles, RAM, storage and bandwidth that they used [2]. These resources would be metered to allow a pay for what you use model much like you buy electricity from the electric company. This is how it became known as utility computing.

'Cloud computing is the name for the whole end to end package provided for a customer who wants to outsource their software, platform or infrastructure to someone , who could provide these 'as a service'. Service providers provide customers a way to access those services in a secure, accountable, reliable, scalable, monitored manner, usually on a pay per use basis [1]. " Cloud" means that things are hidden behind the scenes i.e. they are not transparent or they are cloudy- it is a form of abstraction - so all the customers know is that they get the service they need on demand, but they don't know the details of how it is being done.
It is common for cloud computing to be distributed across many dedicated servers. This provides redundancy, high availability and even geographic redundancy. This also makes cloud computing very flexible. It is easy to add resources to your application. [5]. Cloud computing has been designed with scalability in mind.

Automation of cloud

The concept of cloud computing has captured the attention and imagination of organizations of all sizes .There are many other technical elements to deploying a Cloud environment.
It is a service delivery model that converts the power of virtualization into measurable business value by adding the provisioning and billing capabilities. Automated self-provisioning aspect has make Clouds run [4]. Metering and billing is important to monetize or chargeback costs. Automation is all about monitoring the services provided by Cloud to the customer. It is more over same as our electricity meter. All the services like software, platform or infrastructure are monitored and then bill is generated accordingly. So, automation of services is as much important

as a measuring device of a retailer while selling sugar. Automation has reduced human involvement while speeding up the time it takes to bring new resources. Cloud services are automated by different automation software's so that work of service distribution and billing from customer run smoothly.

Virtualization

Virtualization is an under the cover technology concept that decouples physical infrastructure from the service provided. It is a core enabler of cloud computing [8], because the services must be abstracted in order to allow communication and control through a Web service. e.g., start a php server at the URL www.myphpserver.com.virtualization is a layer of software that lets companies consolidates several of their in-house servers onto a single piece of hardware.

This virtualization model clears what exactly the virtualization is. It is actually a power multiplier which converts one server into multiple providing multiple ends, to use it for different purposes and by different vendors. Virtualization is a technique that allows you to run more than one server on the same hardware. Typically one server is the host server and controls the access to the physical server's resources. One or more virtual servers then run within containers provided by the host server. The container is transparent to the virtual server so the operating system does not need to be aware of the virtual environment [1]. This allows server to be consolidated which reduces hardware costs. Less physical servers also means less power which further reduces cost.

SERVICE HIRING MODEL FROM MULTIPLE CLOUDS

The delivery of Information Technology (IT) services is moving away from a single provider model, and is increasingly based on the composition of multiple (other) services and assets hired from multiple providers [3]. Composed service consists of component services that come from specialized providers. Organizations utilize multiple service providers to minimise risks associated with a single provider. There can be risks in hiring all services from same cloud e.g. service outage, downtime at provider end, security threats, information leakage etc.

Take Care of following

- the virtualized service will meet the SLAs(Service level Agreements)
- decide on what resources to allocate to it
- Choose between providers when selecting component services to be composed. It will also allow a service provider to differentiate from competitors offering a similar service.

Basic portal for hiring services from clouds:

Hiring services from different cloud vendors needs some basic elements e.g.

- user portal
- Cloud service advertisements
- Discovery and negotiation services

These are the basic features needed while establishing a hired model of services from cloud. These are depicted in Figure 1 and its main components are described below:

ISSN: 2277-9655
(I2OR), Publication Impact Factor: 3.785

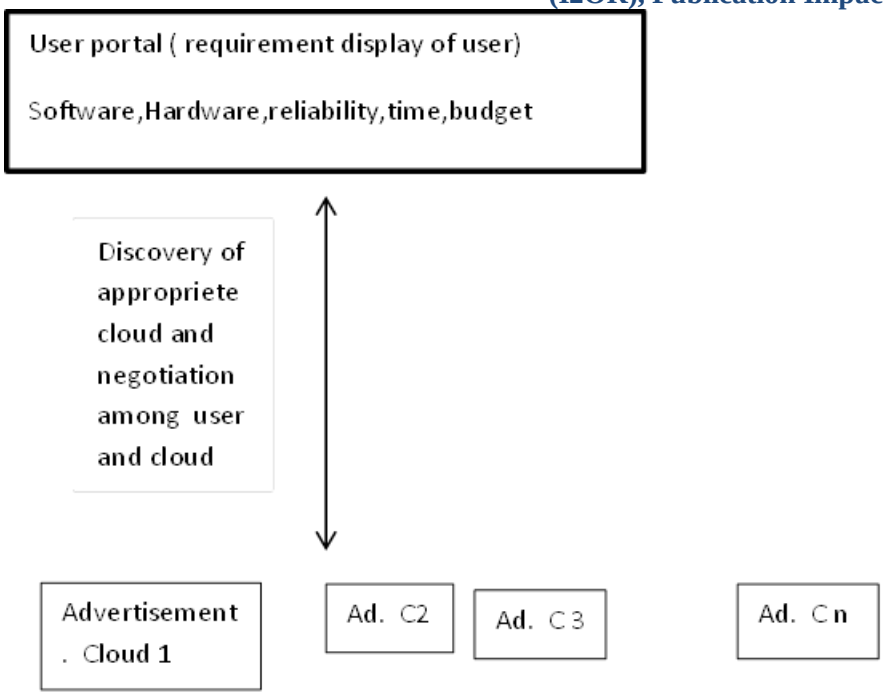

Fig.1

User Portal

All services provided by the system are presented via the web portal to clients. This component provides graphical interfaces to capture users' requirements such as software, hardware, QoS requirements (including maximum acceptable latency, minimum acceptable reliability and budget), firewall, and scaling settings. In addition, it transforms user requirements to format of form of goals [7] which are then used for Cloud service discovery and composition.

Cloud Service advertisements

They are represented by appliance and virtual unit service repositories in Figure 1 and allow IaaS providers to advertise their services. For example, an advertisement of a computing instance can contain descriptions of its features, costs, and the validity time of the advertisement. From standardization perspective, a common met model that describes IaaS provider's services has to be created. However, due to the lack of standards, we developed our own metamodel [7] based on previous works.

Discovery and Negotiation Service

These component maps user's requirements to resources using the ontology-based discovery technique. It acts in user 's interest to satisfy quality of service (QoS) requirements by selecting the set of eligible IaaS providers. The negotiation service uses a time dependent negotiation strategy that captures preferences of users on QoS criteria to maximize their utility functions while only accepting reliable offers.

CONCERNS WHILE HIRING SERVICES

Once we had hired the services from multiple cloud vendors, there are many concerns associated next.

Interoperability/ Compatibility

Interoperability focuses on the creation of an agreed-upon framework, open protocols and APIs that enables easy migration and integration of applications and data between different cloud service providers and also facilities for the secure information exchange across platforms. It is an essential requirement for both service providers and enterprises. For enterprises, it is important to provide interoperability between enterprise clouds and cloud service providers.

The issues of interoperability are to allow applications to be ported between clouds and to use multiple cloud infrastructures before critical business applications are delivered from the cloud. In addition, some issues are relevant in the context of enterprises such as mechanism of incrementally migration of enterprise applications to cloud platforms, procedure to extend enterprises policies and governance to cloud deployments, and design of public clouds to meet enterprise systems scope etc. Furthermore, interoperability might focus how to integrate entire cloud and grid systems into each other across service providers and enterprises as well as to investigate the relevancy of clouds of grids and grids of clouds.

There are many organizations working in the field of enterprise cloud interoperability. Cloud Computing Interoperability Forum (CCIF) [9] is one of them. In this forums, it is discussed whether a mechanism like network weather map is required to monitor the cloud and also what level of user control is needed to allow for inter- operability.

QOS

In general, QoS provides the guarantee of performance and availability as well as other aspects of service quality such as security, reliability and dependability etc. QoS requirements are associated with service providers and end-users. SLAs play a facilitator key role to make agree upon QoS between service providers and end-users.

Transparent management systems to monitor resources, storage, network, virtual machine, service migration, and fault-tolerance are subjected by QoS. The state of art of QoS concept is exactly similar to the Grid Computing paradigm with some additional issues, such as virtualization of IT and network resources, virtual machine image migration. In the context of cloud service providers, QoS should emphasis on the performance of virtualization and monitoring tools.

The question is what the performance requirements are of applications and services that user plan to utilize from the cloud. In the case of high performance SLAs, service provider may still not be able to satisfy the performance levels at all the time due to inherent network latency of Internet. Since users expectations on QoS will always remain high, it is important to set the tolerance level of enterprise.

Business process management

Business process management systems provide a business structure, security and consistent rules across business processes, users, organization and territory. This classical concept is enhanced in the context of Cloud-based BPM, as cloud delivers a Business Operating Platform for enterprises such as combining SaaS and BPM applications (e.g., customer relationship management (CRM), workforce performance management (WPM), enterprise resource planning (ERP), e-commerce portals etc.) which helps for the flexibility, deploy- ability and affordability for complex enterprise applications. When the enterprises adopt Cloud

Based services or business processes, the return of investment (ROI) of overall business measurement is important.

- Pricing and costing of cloud services
- Funding approaches to cloud services
- Return of Investment (ROI)
- Capacity and utilization (called as Key Performance Indicators (KPIs))
- Total cost of ownership
- Risk management
- Decision and choices evaluation processes for cloud services

Reusability of business processes can help the enterprises to maximize their profits and some of the intelligent/innovative business processes such as *situational business processes* [11] would be fruitful to drive the business values.

Cost

Although cloud computing is all about saving the costs of establishing their own datacenters by customers. Customers hire appliances and servers from different vendors, still there are some initial costs associated with data transfer to the appliance of other vendors.

- Acquisition Cost: Costs involved in purchasing the virtual appliance, such as licensing cost, cost of the virtual machine and any costs associated with deployment such as the data transfer costs to transfer the appliances to the virtual machine at the IaaS provider.

- Ongoing Cost**:** This will include the costs of running the virtual appliance, such as the cost of data transfers. In this work we consider only the costs associated with data transfers between two servers or appliances as ongoing costs.
- Decommissioning Cost**:** Decommissioning cost primarily includes archival and removal costs of the data at the end of the application life cycle such as the data sanitization, and will depend on the size of the data stored. The amount of data stored will vary from server to server.

So, the Total cost will be addition of all the three costs described above.

Deployment time

Virtual appliances significantly minimize the time required to build and configure the necessary independent components. The large sizes of virtual appliances impacts the time required to transfer and deploy the appliances from the appliance provider to the virtual machine provider. So, it is also one of the composition objectives of user to minimize the deployment time.

User Requirements

Users' requirements are the third key factor to the adoption of any cloud system within an enterprise.

- Cloud should be trustworthy enough to migrate critical user data. Users need assurance that their sensitive data and information are protected from compromise and loss that their data is available when required from anywhere of the world.
- For users, the trust issues are a major concern to the adoption of the cloud services. Trust-based [12] cloud is therefore an essential part to the success of enterprise cloud.
- Stability and security can play a vital role to increase the trust between user and service providers.
- Cloud-based applications should be architected to be able to support personalization, localization and internationalization to make user-friendly environment.

APPLING HIRING MODEL ON THE FRAMEWORK

Here we **are** applying the model of hiring services from different clouds on the following framework :
Getting virtual machine and virtual appliance (storage) from two different cloud vendors [8].

Problem Statement is to find the best combination of compatible virtual appliances(e.g. storage) and virtual machines(e. g. server) that minimizes the deployment cost and deployment time, and maximizes the reliability while adhering to composability constraints.

Provider and User Request Model

Let m be the total number of providers or cloud vandors offering virtual services. Each provider provide virtual appliances, virtual machines or both and is represented as shown in Equation (1). The term virtual appliances are generally used for storage solutions hired from cloud vendors and virtual machines for virtual server.

Provider P_k : {{a},{v_m},C_{dext},C_{dint}}

Where $0 < k \leq m$

Here P is the different cloud vendors from where different appliances and machines are hired by the customers. a, v_m, C_{dext} , C_{dint} denotes virtual appliance, virtual machine, Cost of external data transfer and Cost of internal data transfer respectively. A virtual appliance a can be represented by a tuple of five elements (Equation (2)): appliance type, cost, license type, compatibility list and size.

a: {Appliance Type, Cost, License Type, Compatibility List, Size}

When multiple cloud services (i.e. virtual appliances and units) are composed together, they should be compatible with each other. We consider legal and image format compatibility constraints. However, it should be noted that in reality there will be other compatibility constraints such as compatibility between the products installed on the appliances.

Our objective is to achieve full compatibility among the appliances in the composition. Based on the compatibility constraints considered in our work, the compatibility (C) can be calculated based on Equation (3).

C= { 0 there exits at least one pair of incompatible services

1 otherwise.

Following algorithm calculates the compatibility between virtual appliances and machines that we hired from different vendors. Here each composition c consists of some virtual appliances and virtual machines from different cloud vendors. Each composition deals with some constraints. We have following functions in algorithm:

Compositionvalidity(c,cl) : This function has two inputs c is composition list and cl is constraint list.
If composition validity exists in cache **than** value of **ValidComposition** is set to **true** and if it does not exists in cache than Value of **validcomposition** becomes **false** .
And **if validcomposition** is **false than** we **checkcompatabilitybyreasoning** that is use reasons for incompatability and try to make them compatible.

And **if** it happens **Insertcompositiontocache(t,a,vu)** for corresponding constraints t, virtual appliance a and virtual machine vu. So this algorithm returns **validcomposition** as a result showing that whether the compostion hired from different vendors are true or false.

```
Input: Composition c, Constraint List (cl)
 Output:  Composition Validity
if CompositionValidity(c , cl) Exists in Cache then
ValidComposition = true
GetCompositionValidityFromCache(c, cl);
end
ValidComposition=True;
foreach Appliance a and Virtual Unit  vu In c do
  foreach Constraint  t in cl do
     if   Compatibility (t, a, vu) Exists in Cache then
          ValidComposition = true
           GetCompatibilityFromCache(t, a, vu);
   end
    else
      validComposition = false
       CheckCompatibilitybyReasoning(t, a, vu);
  end
InsertCompatibilitytoCache(t, a, vu);
end
if ValidComposition=False then
break;
end
end
Insert CompositionValiditytoCache(c,cl);
return ValidComposition;
```

Algorithm 1: Compatibility evaluation algorithm

So, above algorithm gives compatibility as a result among services hired from different clouds. In this way we can achieve the motive of this paper.

Similarly, we need to check for other user requirments while hiring services from multiple clouds e.g. minimizing the deployment cost and deployment time, and maximizing the reliability while adhering to composability constraints.

CONCLUSION AND FUTURE WORK

As we here calculated compatibility of different services hired from different vendors of cloud. Similarly cloud services cost, quality, time of deployment needs to be correlated. As in above algorithm we have checked for two services compatibility, similar algorithms needed while hiring multiple services from different cloud vendors. So conclusion is more over towards indicating that this paper is reviewing only basic work and lots of algorithms need to be deployed in future.

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