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Approximation Approach Based on Communication and Hosting Costs and for Service Based Applications for Improving Efficiently



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Abstract:

Cloud computing, the imminent need of computing as a finest utility, has the latent to take a enormous leap in the IT industry, is structured and put to optimal use with regard to the current tendency. In the present era, organizations are more and more using cloud environments to deploy and run applications. In this view, it is needed to provide and manage software and hardware resources within the organization and acquiring additional resources, those are externally provided by public clouds as and when they need the resources.

Later in advancement to this feature, some components are placed in private cloud and some in public cloud. With this NP-Hard problem has given rise and in order to overcome this, an approximation approach based on communication and hosting costs and for service based applications are efficiently modeled by using efficient algorithms presented in the paper.

I.INTRODUCTION

The term cloud computing refers to the delivery of scalable IT resources over the Internet, as opposed to hosting and operating those resources locally, such as on a college or university network. There are four different deployment models of cloud computing. They are Public cloud, Community cloud, Hybrid cloud and Private cloud.



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A).Public Cloud: A public cloud, or external cloud, is the most common form of cloud computing, in which services are made available to the general public in a pay-as-you-go manner [10]. The public cloud model is widely accepted

and adopted by many enterprises because ,the leading public cloud vendors as Amazon, Micr osoft and Google, have equipped their infrastr ucture with a vast amount of data centers, enable ng users to freely scale and shrink their rented resources with low cost and little management burden.

B).Private Cloud: A Private Cloud, or internal cloud, is used when the cloud infrastructure, proprietary network or data centre, is operated solely for a business or organization, and serves customers within the business fire-wall [10].



Fig1: Types of Cloud

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C).Hybrid Cloud: A composition of the two types (private and public) is called a Hybrid Cloud, where a private cloud is able to maintain high services availability by scaling up their system with externally provisioned resources from a public cloud when there are rapid workload fluctuations or hardware failures [10].

D).Community Cloud: The idea of a Community Cloud is derived from the Grid Computing and Volunteer Computing paradigms. In a community cloud, several enterprises with similar requirement can share their infrastructures, thus increasing their scale while sharing the cost [10]. The benefits of cloud computing for an enterprise include, increased flexibility and market agility as the quick deployment model of cloud computing increases the ability to reprovision rapidly as required.

In cloud environments, the diversity of requirements for hosting services in the Cloud makes the management of Cloud applications and resources a challenging task. In this paper, we are interested in application division across clouds and particularly the division of service-based applications (SBAs) in hybrid clouds. The advantage of such a hybrid cloud deployment is that an organization only pays for extra compute resources when they are needed. Cloud Bursting is an application model where organizations can utilize the compute resources of one cloud and burst in to another cloud when the demand for computer resources exceeds the limit allowed in the current cloud.

Cloud Bursting Scenarios:

- (i) Cloud Bursting from a private cloud in to a public cloud.
- (ii) Cloud bursting from one private cloud in to another private cloud.
- (iii) Cloud bursting from one public cloud in to another public cloud.



Fig 2: Cloud Bursting

The placement of resources at different levels are not considered for communication between services of hybrid cloud. Formulation of the bursting of services within a hybrid cloud results in NP-Hard problem. To overcome this problem, an algorithm has proposed to produce optimal placement solution. The algorithm proposed in this paper, is efficient for the bursting of behavior-based compositions and also for architecture Based compositions of services.

II. Problem Statement

The problem of placement of resources in cloud environments has been tackled from IaaS. PaaS and SaaS views, while considering private, public and hybrid clouds) from different criteria. Earlier many authors has presented algorithms to allocate platform resources for service placem ent, approach for optimizing the placement of virtual resources at the level of infrastructure across multiple clouds, a penalty-based genetic algorithm for the placement of components and data(used by these components) that optimize the SaaS performance. All these approaches are suitable for the placement in public or private clouds but not for hybrid clouds. Hybrid cloud communication costs between services depend on the placement of services where public and private communications should be differentiated. The placement of applications in public/private clouds is a matter of placement of a virtual network on a physical



network that represents the cloud nodes and links. In the present scenario, the work is carried out on its formulation and its cost function and are specified that they are different from those of the approaches referenced above.

Approaches that optimize bursting of resou rces in hybrid clouds:

A scheduling model for optimizing virtual clus ter Placements across available cloud offers was proposed in [15] and in [16]. In [17], the authors present an approach that tries to minimize the cost of provisioning workload in hybrid IaaS clouds which consists in outsourcing partial Workloads from private to public clouds. In [18], [19], [20], the authors propose several approaches for placement of virtual machines across multiple clouds. There are three cases in view of applications that should be deployed in its private cloud as long as the needed resources can be provided by the private cloud:

- Already deployed applications request more resources the private cloud could not provide.
- Already deployed applications release resources so that a re-deployment can be envisaged to release allocated resources in the public cloud.
- New deployment requests to be fulfilled cannot be satisfied by the private cloud.

Here, we consider that almost all the private resources that are consumed and they have to be supported in any case. So we have to decide about services that are to be deployed in the public cloud is equivalent to minimize costs of hosting in the public cloud and communications between the private and the public cloud and in the public cloud. But this minimization problem is subject to a constraint. Indeed, the hosting quantity of deployed services in the public cloud is to be greeter or equal to HQ.

III. Problem Formulation

The deployment of a SBA modeled as SBA graph as it is described above can be formulated as a programming problem as follows. Minimize: H + PC + HC

Subject to:

$$\sum_{i=1}^{n} h(s_i) \times l(s_i) \ge HQ$$

Where:

$$H = \sum_{i=1}^{n} \alpha \times h(s_i) \times l(s_i)$$

$$PC = \sum_{e = \langle s_t, s_j \rangle \in E} \beta_2 \times c(e) \times l(s_i) \times l(s_j)$$

$$HC = \sum_{i=1}^{n} \sum_{j \ s.t. \ e = \langle s_t, s_j \rangle \in E} \beta_1 \times c(e) \times l(s_i) \times (1 - l(s_j))$$

H is the sum of hosting costs of services deployed in the public cloud. PC is the sum of public communications (communications betwe en services deployed in the public cloud).HC is the sum of hybrid communications (communic ations between services deployed in the public cloud and those deployed in the private cloud).

IV. Our Approach: Service-Based Applicat ions In Hybrid Cloud

SBAs consist in assembling of a set of services using appropriate service composition specifica tions that can be architecture-based like Service Component Architecture(SCA [5]) and UML component diagram [6]or behavior-based like Business Process Execution Language (BPEL [7]) and Business Process Model and Notation (BPMN [8]). The two types of compositions are given below with examples.

- a) Behavior-based compositions
- b) Architecture-based compositions

4.1Behavior-based compositions: A SBA com posed using a behavior-based specification can be described as a structured process which consists of a set of process nodes and transitions between them. A process node can be service, Or-Join, Or-Split, And-Split or And-Join. And-Joins and Or-Joins should have at least two ingoing transitions and at least one outgoing transition. And-Splits and Or-Splits should have at least one outgoing transitions. Non-initial and non-final services have one ingoing transition and one outgoing transition.

Definition 1 (Structured process):

A structured process is inductively defined in [23] as follows: As an example of a structured process, we consider a business process of an online shopping purchase order of a clothing store called Cloth Store (fictitious name). Cloth Store offers products to its customers, interacts with two suppliers and a shipper for processing orders. It holds certain products in stock, and orders others from suppliers in case of product lack.

The second supplier is contacted only if the first one hasn't the required quantity or articles. The structured process of Cloth Store is illustrated in the BPMN diagram shown in Figure 1. The customer sends a purchase order request with details about the required products and the needed quantity. Upon receipt of customer order, the seller checks product availability. If some of the products are not in stock, the alternative branch ordering from suppliers is executed. When all products are available, the choice of a shipper and the calculation of the initial price of the order are launched. Afterwards, the shipping price and the retouch price are computed simultaneously.



Fig 3: Example of an SBA application

The total price is then computed in order to send invoice and deliver the order. Finally, a notific ation is received from the shipper assuring that the order is already delivered.

4.2 Architecture-based compositions:

A SBA composed using an architecture-based composition can be described as a set of linked components. A component provides one or more services. It may consume one or several references, which are services provided by other components.

Connection of one reference and one service is realized by a wire. We consider the on-line store example using a UML component diagram [6]. This diagram illustrates various components and services they offer to form a SBA. It shows how components refere nce services offered by other components. Offered services are defined through interfaces. These interfaces represent the contract between components.



Fig 4: Example of an Online store

The example is a composition of four services. The Store service provides the interface of the on-line store. The Catalog service which the Store service can ask for catalog items provides the item prices. The Currency Converter service does the currency conversion for the Catalog service. The Shopping Cart service is used to include items chosen from the Catalog service.

4.3SBA Graphs: Based on the above consider ations, we can model a SBA like the one present ed as a graph. Services, Or-Join, Or-Split, And-Split and And-Joinnodes will be represented by graph nodes and connect ions / transitions between services will be represented by edges. Nodes are identified by an ID (a URI ora number) and characterised by an amount of units of hosting resources. Edges are characterized by an amount of communications units which refers to the amount of traffic that is transferred on the considered edge.



Fig 5: SBA graph of Online Store



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Fig 6: Online store deployed on a hybrid cloud.

4.4 Services in SBAs:

Services that compose SBAs can be identified by URIs and characterized by their interfaces, bindings and implementations. Services may be implemented with several programming languages (C++, Java, etc.), support several communication protocols (RMI, SOAP/HTTP, etc.) and/or run on several hosting frameworks (POJO, .NET framework, component based platform, etc.). A service implementation requires specific platform resources for its deployment such as a container with specific sizing. A connection between two services is characterized by the amount of data flow to be communicated between services. For example, the Catalog service is bound using the JSONRPC binding, and the Shopping Cart service is bound using the ATOM binding. The Store service is implemented in HTML and JavaScript and the Catalog service is implemented in Java.

V. Implementation: Algorithms for an Efficie nt Bursting:

The two algorithms for the bursting of service-based applications in hybrid clouds are based on three procedures called Forward, Backward and Refinement. We present after the first algorithm based on the Forward and Backward procedures. The second algorithm we propose here is based on three combinations of the Forward, Backward and Refinement procedures.

5.1Forward-Backward (FB) algorithm: The Forward-Backward algorithm (FB algorithm for short) is a first approximate bursting algorithm that calls first the Forward procedure and then the Backward procedure[10].

Algorithm : FB procedure Require: Graph : <S,E, h, c, l> SBA graph Ensure: Public: set of application nodes in the public cloud Ensure: Private: set of application nodes in the private cloud 1: Public, Private ←Forward(Graph) 2: Public, Private ←Backward(Graph, Public, Private) 5.2 Forward-Backward-Refinement (FBR) algorithm: Require: Graph : <S,E, h, c, l> SBA graph Ensure: Public: set of application nodes in the public cloud Ensure: Private: set of application nodes in the private cloud 1: Public, Private \leftarrow Forward(G) 2: Public1, Private1 ←Backward(G, Public, Private) 3: Public1, Private1 ←Refinement(G, Public1, Private1) 4: Public2, Private2 ←Refinement(G, Public, Private) ←Backward(G, Public2, 5: Public2, Private2 Private2) 6: Private3 $\leftarrow \emptyset$; 7: Public3 \leftarrow Graph:S 8: Public3, Private3 ←Backward(G, Public3, Private3) 9: Public3. Private3 ←Refinement(G, Public3.Private3) 10: choose i s.t.cost(Publici; Privatei) <=cost(Publicj; Privatej); j = 1; 2; 311: Public ←Publici 12: Private ←Privatei

VI Empirical Evaluation:

To evaluate our proposed algorithms for the placement of services in hybrid clouds, we compared its quality of responses against an algorithm that calculates for each graph all possible partitions (Public,Private) and evaluate them to choose an optimal solution that satisfies the quadratic programming problem. We consid ered in all our experiments that the cost of a communication unit between the public and the private clouds is greater than the cost of a communication unit inside the public Cloud. The distance between the optimal and our approximate solutions can be qualified



by the percentage of loss that is equal to (CAS - COS)X100/COS, where COS is the cost of an optimal solution and CAS is the cost of the approximate solution.

Graphs	Nodes	Edges	Hosting needed	Density
G1	15	14	573	13%
G2	14	18	581	20%
G3	11	17	433	30%
G4	17	54	791	40%
G5	18	77	880	50%
G6	13	47	589	60%
G7	15	74	652	70%
G8	17	109	737	80%
G9	12	59	428	90%
G10	16	120	687	100%

TABLE 1: Characteristics of generated graphs



Fig 8: Varying Hosting costs

VII. Conclusion and Future Scope:

In this paper, we considered hosting and comm. unications costs as criteria for service bursting of SBAs in hybrid clouds. We tackled in this paper a NPhard problem related to the bursting of a service-based applications to be deployed in hybrid clouds. This consists in determining a partition of the set of services composing the application while minimizing the hosting and communication costs. The partition is composed of two subsets: Private and Public. Services in Private are to be deployed locally in the private cloud and services in Public are to be deployed in the public cloud. FRB algorithm has a good behavior not only for architecture-based compositions but also for those based on behavior. In our future work, we will consider additional parameters such as security and privacy.

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