CIMP: Cloud Integration and Management Platform

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Abstract. Cloud Computing has emerged as a model, where all the essential components of a computer system such as software applications, platforms for software development or physical infrastructure are considered as services. Nowadays, the Cloud services offered is very diverse in terms of hardware and software, providing a wide range of configurations, and great flexibility. In this paper we propose a Cloud Integration and Management Platform (CIMP), aimed to act as an intermediate between users and Cloud solutions and offers additional components that enhance their functionalities. In addition, we propose an experimental validation showing the feasibility of our approach.

Keywords: Cloud solutions, Openstack, Dynamic Reconfigurable Component, Cloud Migration.

1 Introduction

Today's information system (IS) becomes increasingly complex making it difficult to follow the complex growing demands of information technology (IT) resources requirements. This leads to study and suggest new approaches to rationalize and optimize these resources.

In this way, a new concept of Cloud Computing has emerged as a technical and economic model for the use of IT resources [1]. This is the new trend of computing where IT resources are dynamically scalable, virtualized and exposed as a service on the Internet [2]. Cloud Computing is often associated with the supply of new mechanisms that allow providers to give users access to a virtually unlimited number of resources (Resource Outsourcing) [3].

In the Cloud, the equipment is provided in the form of virtual machines running by a hypervisor software. Each virtual machine is characterized by a set of hardware resources, consisting essentially of CPU, memory and external storage network, software and platform. The provisioning of virtual machines is on-demand and dynamically allocated to users. In Cloud system, the clients order resources in the form of a lease, but in general they use fewer resources than requested. These unused resources are a loss for the users as well for the provider.

Different solutions exist for the deployment of open source Clouds. Among these, Nimbus [4], Eucalyptus [5], OpenStack [6], OpenNebula [7] and Cloudstack [8].

We present in this paper, a Cloud Integration and Management Platform (CIMP) that aimed to:

- Integrate Cloud solutions for Cloud provider.
- Capture user specifications and translate them into commands that will help generate the Cloud settings.
- Provide additional components that enhance the functionality of Cloud manager or provide missing functionality.

In the remaining of this paper, a review of the related work is presented. Then a presentation of CIMP architecture is giving. We present the CIMP Interface and components. Then, the result of the implementation is shown using OpenStack.

2 Related works

Several Cloud solutions are available nowadays:

Eucalyptus [5] is a solution that allows the installation of a private and hybrid Cloud infrastructure, with a main storage controller walrus and controllers on each node.

OpenStack [6] is an open source Cloud Computing solutions. OpenStack controls large pools of compute, storage, and networking resources.

OpenNebula [7] is an open source project aimed at building the industry standard opensource Cloud Computing tool to manage the complexity and heterogeneity of large and distributed infrastructures.

Apache CloudStack [8] is an opensource solution designed to deploy and manage large networks of virtual machines as Infrastructure-as-a-Service (IaaS).

Recent studies have addressed the use of managing Cloud environments.

In [9], the authors present current efforts to develop an opensource Cloud Application Management Framework (CAMF) based on the Eclipse Rich Client Platform.

The paper [10] present a CloudTUI-FTS tool able to interact with different Cloud platforms, the user can perform both basic tasks (e.g., start-up/shut-down a service) and advanced tasks (e.g., create policies and mechanisms to prevent faults and to provide service scalability).

The different Cloud solutions contain some common components and modules like: Compute node, Network, Dashboard, Virtualization, VM.

We focus mainly in this paper on integration and management platform for the optimization of Cloud management. We discuss the development and the implementation of CIMP and component for helping tenant to select an objective parameters initialization. It can be done with Interface and Components.

3 Cloud Integration and Management Platform

The Cloud solutions are comprised of a set of components aimed to manage Cloud resources. As shown in figure 1, the KPI measuring, is used to collect measurements data, and is transferred to the component for apply policy.

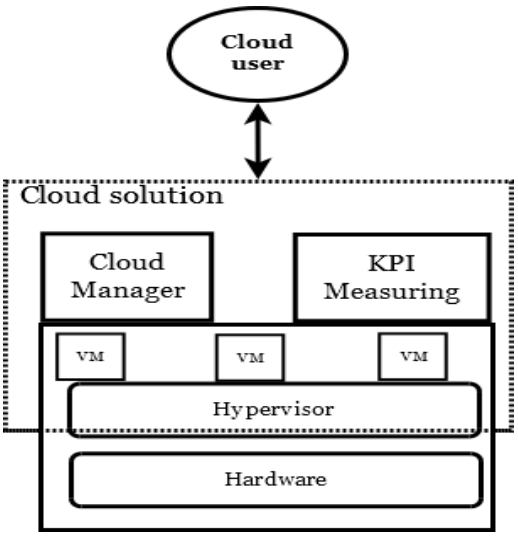

Fig. 1. Components of Cloud Solution

In order to integrate a many different Cloud solutions, we propose the CIMP platform as shown in the figure 2, where the CIMP act as an intermediary between users and Cloud Computing solutions, different users (U1, U2, ... Un) can exploit the CIMP that supports multiple Cloud deployment solutions (CS1, CS2, ... CSm).

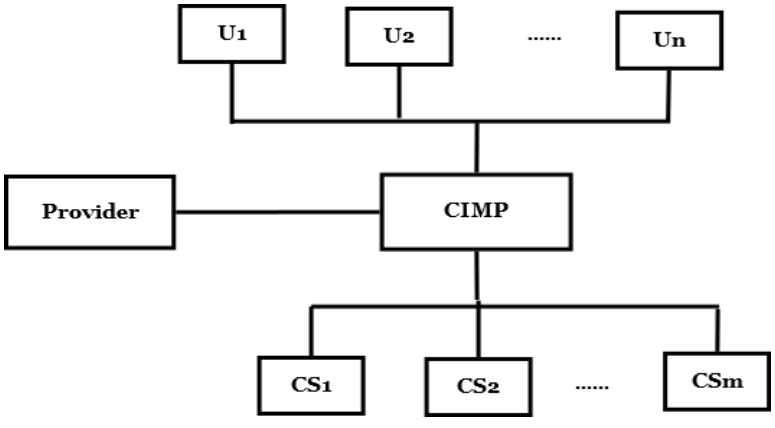

Fig. 2. Integration of Cloud solutions in CIMP

3.1 CIMP Architecture

The CIMP allows capturing user requirements and translating them into commands for the Cloud parameter settings [11]. As shown in figure 3, the CIMP is composed of Interface and Components.

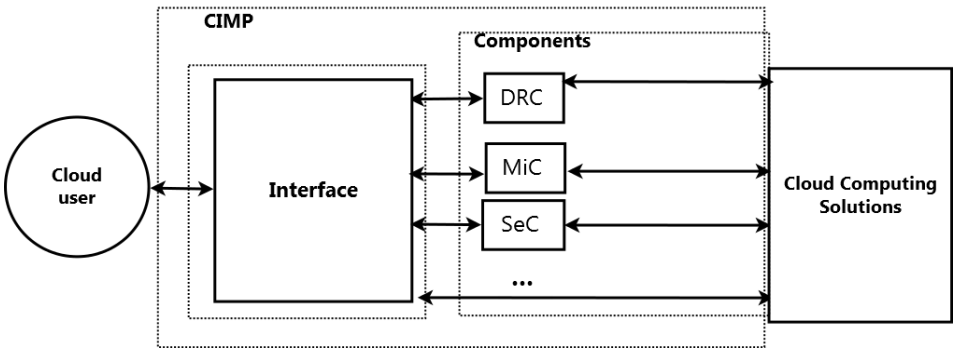

Fig. 3. CIMP architecture

The CIMP consists of several components; each plays a different role and defines the user and the provider profits to meet the different needs of optimization, performance, security, QoS and cost. Among these components as shown in figure 3, we find:

- Dynamic Reconfigurable Component (DRC): The DRC component optimizes the use of Cloud resources and enables dynamic resource allocation. This component determines the optimal solutions depending on policy and strategy defined by users.
- Migration component (MiC): The MiC component allows the users to select the services it wishes to move; outsource the software, platform or infrastructure services.
- Security component (SeC): The SeC component can improve the security mechanism offered by Cloud providers, deploying their own security policies and could be developed as a perspective of this paper.

When new features are missing or insufficient, the CIMP uses additional components to overcome this deficiency and add missing functionality to the Cloud solution.

In the remaining, the CIMP Interface and MiC component are presented in the next sections.

3.2 CIMP Interface

The CIMP interface allows the tenant to select the configuration functions. These parameters reflect the actual needs of the user. Among these parameters, we find:

- User Activity (e-commerce, web blog...)
- User resource need (small, medium, huge, wide)
- Dynamic behavior (yes, no)
- Migration Services (SaaS, PaaS, IaaS)
- Security level (low, medium, strong)

The CIMP interface is used to evaluate the user requirement parameters, and to determine and propose configuration commands as shown in figure 4. The Requirements module allows the user to specify the required resources. The Dashboard module provides users a graphical interface to access, provision, and management of Cloud resources. The Commands module allows adding new parameters to the Cloud resources.

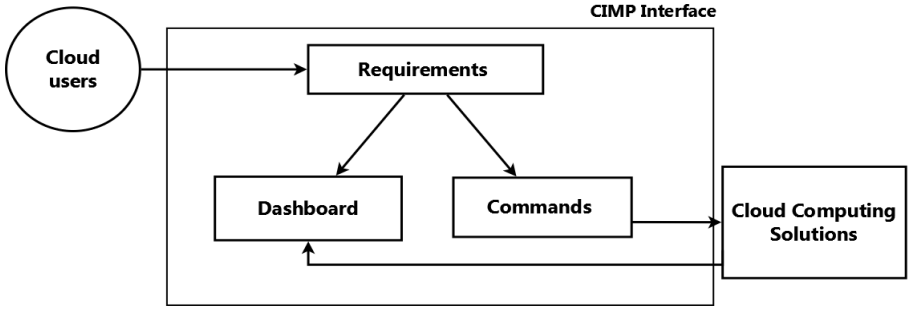

Fig. 4. CIMP Interface

The commands are deducted from the requirement parameters in two ways:

1. The parameters of the user activity allow determining the characteristics of Cloud resources, and therefore the configurations of the virtual machines.
2. All remaining parameters are translated to the adjustment of these resources. Depending on the type of user activity, the level of resource requirements and the choice to enable or disable the dynamic behavior of specific requirements selected by the user, the CIMP generates the appropriate commands.

Finally, using these commands, the CIMP interface generates various parameters and Cloud adjustment instructions, necessary for the control and management of Cloud. The commands can directly control components or modify Cloud settings.

3.3 MiC Component

Generally, the migration process involves porting of applications, the software development platform and the entire IS infrastructure in the Cloud. The organization maintains that connection and consultation tools

The MiC component allows the user to select the services it wishes to move. Among these services, we find:

IaaSM : IaaS Migration
PaaSM : PaaS Migration
SaaSM : SaaS Migration

With MiC component, the user will choose the service they desire to outsource. The component directs it to the relevant service of the Cloud environment to start the migration process as shown in figure 5.

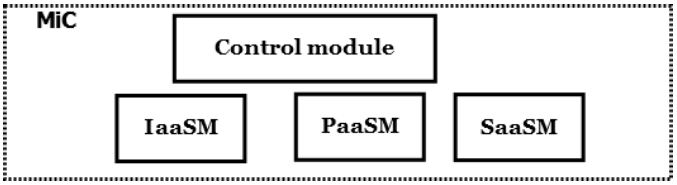

Fig. 5. MiC Architecture

4 Experimental results

To demonstrate the feasibility of the CIMP, we used a testbed based on the OpenStack Cloud [6]. OpenStack architecture is built using many components such OpenStack Compute, Block and Object Storage, Networking, Identity Service, Dashboard, Ceilometer, Orchestration, Database and many others projects [6]. The other Cloud solutions can also be integrated due to the interoperability of the CIMP.

The CIMP is composed by a CIMP interface and a MiC component module. The CIMP interact with the underlying Cloud environment via RESTful API to guarantee the independence and Cloud solutions interoperability.

To demonstrate the efficiency of MiC, and to show the result provided, we propose to test our approach. The classical architecture of an organization's information systems represents some basic elements for the operation of a number of services. We consider that the organization needs to accommodate for example, a website, a database (DB), a set of machines connected together through a local area network (LAN) that is connected to the outside (Internet), a development environment and application of the organization's activities. Users of the organization (U1, U2, U3) are connected to the Internet through the network equipment as the gateway and router.

Migration service PaaS platform as shown in figure 6, will allow the organization to leave the infrastructure management and the development environment to the Cloud provider.

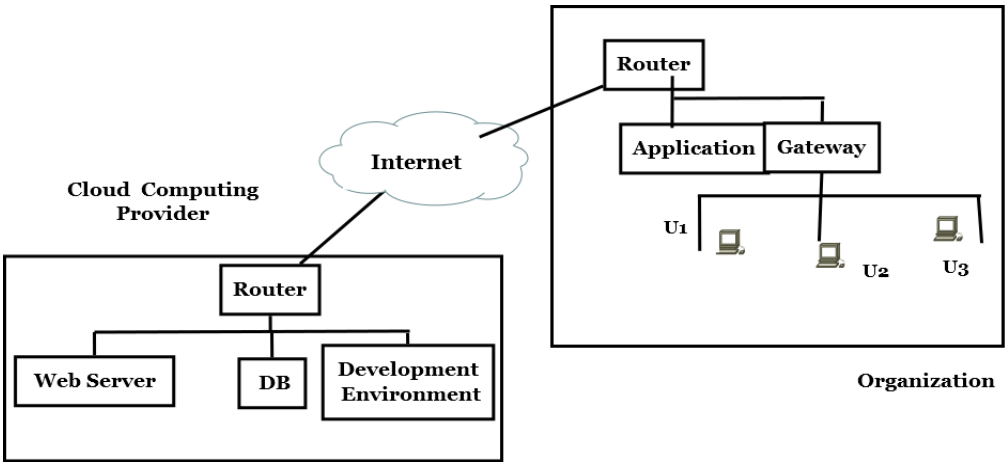

Fig. 6. Migration service PaaS

The figure 7 show the deployment of the migration to PaaS service, the organization will outsource the service database (DB), web server and development environment to the Cloud.

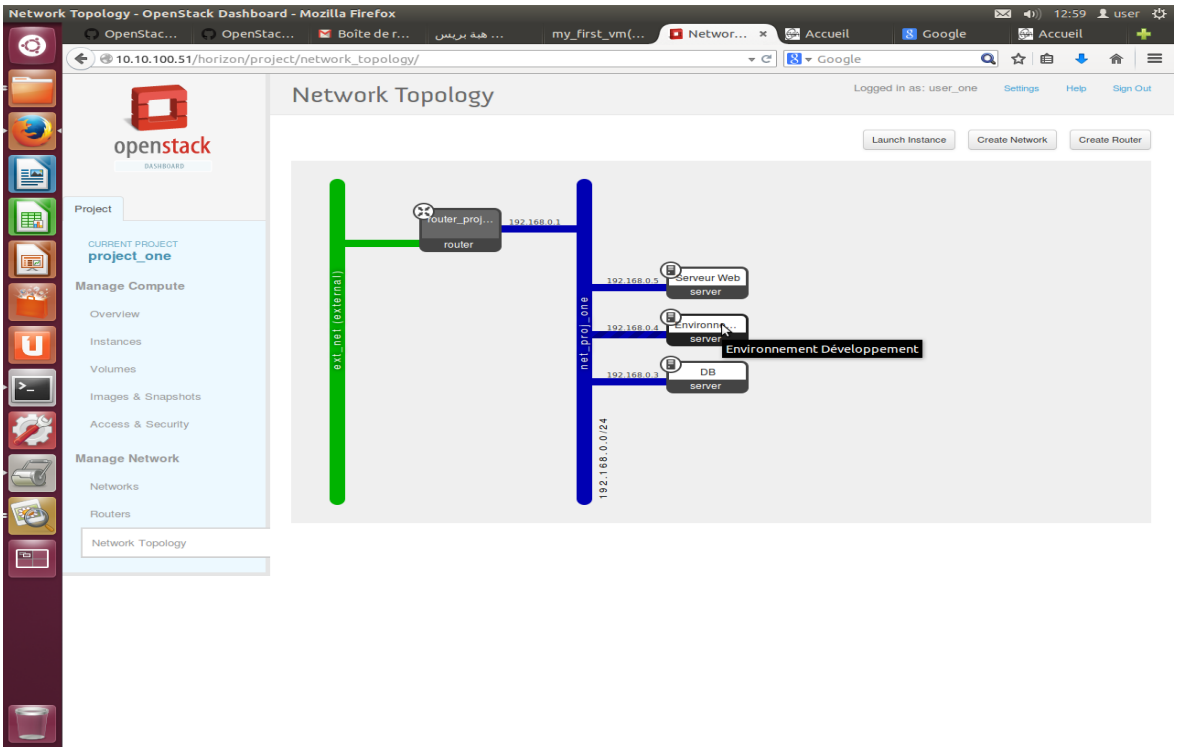

Fig. 7. OpenStack Deployment – PaaS

The Figure 8 shows an example of PaaS service migration. This example shows a program developed in C, which calculates the maximum and minimum number of a table. The editor and compiler program is hosted by the provider while the executable is hosted by the organization.

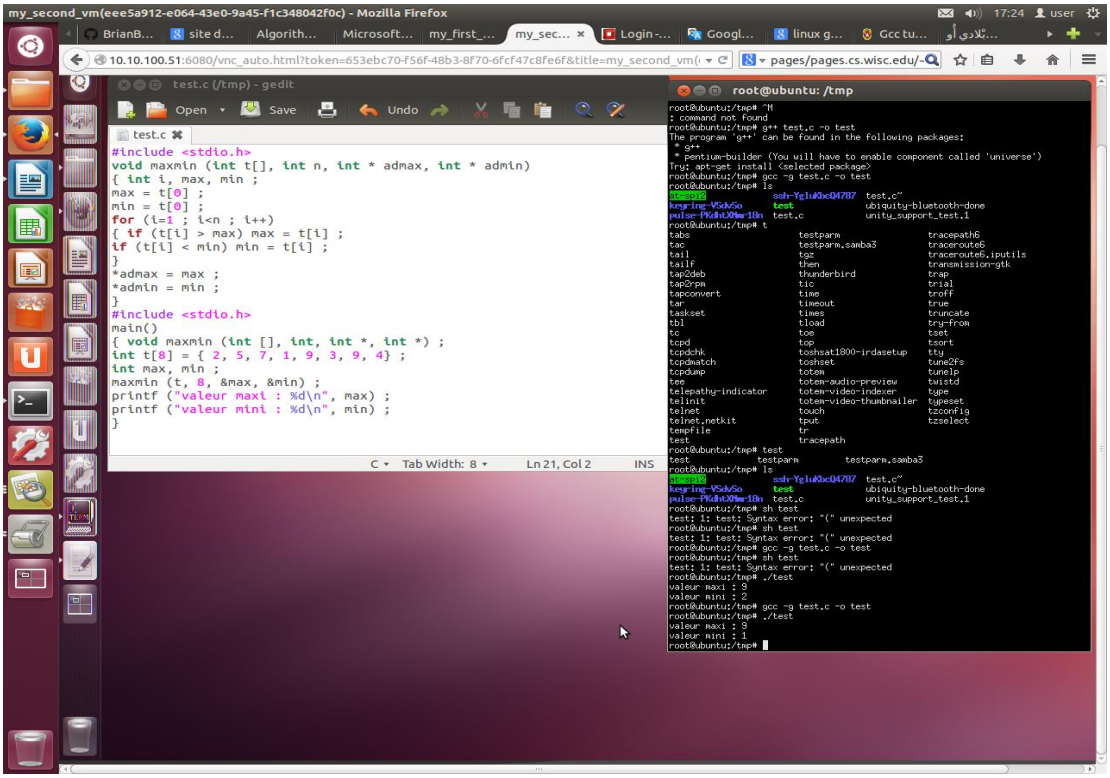

Fig. 8. Example of PaaS migration service

5 Conclusions

In this paper we introduced the Cloud Integration and Management Platform (CIMP). The CIMP is an open source, scalable, interoperable and extensible.

The CIMP is composed of an interface and some components such as DRC and the MiC. The implementation of these is proposed to act on the Cloud resources required to provide integration of Cloud solutions and an optimized environment to the needs defined by users, and offer them the opportunity to choose and to outsource their services to the Cloud. These components could be useful for the Cloud user as well as for the provider

In continuity of this work and to improve the functionality of the CIMP, the concept of artificial intelligence could be used to develop an intelligent CIMP. In addition, other components may be integrated in the platform.

References

[1] Puthal, D., Sahoo, B. P. S., Mishra, S., Swain, S.: Cloud computing features, issues, and challenges: a big picture. In: Computational Intelligence and Networks (CINE) on International Conference, IEEE, pp. 116-123. (2015).

[2] Botta, A., de Donato, W., Persico, V., Pescapé, A.: Integration of cloud computing and internet of things: a survey. Future Generation Computer Systems, vol 56, p 684-700 (2016).

[3] Jennings, B., Stadler, R.: Resource management in clouds: Survey and research challenges. Journal of Network and Systems Management, 23(3), p 567-619 (2015).

[4] DePalma, N., Breazeal, C.: NIMBUS: A Hybrid Cloud-Crowd Realtime Architecture for Visual Learning in Interactive Domains. In: arXiv preprint arXiv:1602.07641 (2016).

[5] Bharati, P. V., Mahalakshmi, T. S.: Data Storage Security in Cloud Using a Functional Encryption Algorithm. In: Emerging Research in Computing, Information, Communication and Applications, pp. 201-212. Springer Singapore (2016).

[6] Openstack project, http://www.opnstack.org/

[7] Vogel, A., Griebler, D., Maron, C. A., Schepke, C., Fernandes, L. G.: Private IaaS Clouds: A Comparative Analysis of OpenNebula, CloudStack and OpenStack. In: Euromicro International Conference on Parallel, Distributed, and Network-Based Processing, pp. 672-679, IEEE (2016).

[8] Nanig, T. T.: Private Cloud Deployment Model for Academic Environment Using CloudStack. In: Genetic and Evolutionary Computing, pp. 155-164, Springer International Publishing (2016).

[9] Loulloudes, N., Sofokleous, C., Trihinas, D., Dikaiakos, M. D., Pallis, G.: Enabling interoperable cloud application management through an open source ecosystem. IEEE Internet Computing, pp. 54-59. (2015).

[10] Canonico, M., Monfrecola, D.: CloudTUI-FTS: a user-friendly and powerful tool to manage Cloud Computing Platforms. In: Proceedings of the 9th EAI International Conference on Performance Evaluation Methodologies and Tools, pp. 220-223. ICST (Institute for Computer Sciences, Social-Informatics and Telecommunications Engineering) (2016).

[11] Sefraoui, O.: Towards management platform Cloud solutions. Doctoral dissertation, UMP (2015).