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Improved Reliability by dynamic selection of scheduling algorithm in testing and real time cloud environment

Jeba Gazelle[1], Dr.M.A.Maluk Mohamed[2]

Research Scholar, Information and Communication Engineering,Anna University,Chennai,India [1]

Professor, MAM College of Engineering,Trichy,India [2]

Abstract: Reliability is a very important parameter to assess the viability of a system. In today's world cloud computing utilizes more resources and hence more failures are likely to occur in the system. Before deploying a cloud system it is essential to ensure that the required assurance on the quality of the system is provided. This paper surveys on the different areas in which reliability has to be ensured in cloud computing starting from reliability on the simple APIs that is used in a cloud system and on ensuring reliability by assessing the system using different reliability rules and by continuous monitoring. The concepts that is explained in this paper can be used for future research and for obtaining a more unified reliability assurance frame work for cloud computing.

Keywords: API, Cloud computing, PaaS, IaaS, SaaS, Testing reliabilty

INTRODUCTION

Cloud computing utilizes resources more efficiently with virtualization technology. A physical server can deploy many virtual machines and operating systems. However, with the increase in software and hardware components, more failures are likely to occur in the system. There has to be various checks that have to be done on an erected cloud environment or an application deployed in cloud to ensure that they are not slowing down performance and the respective SLAs are met.Due to the critical nature of jobs executed in many real-time systems, high reliability becomes an inherent requirement of such systems, and this is especially true for hard real-time applications.The key factor that helps in obtaining high reliability is scheduling. A Scheduler mainly deals with controlling throughput,latency,waiting time and in allocating equal CPU time to each process. For any cloud application or system that is being erected it is important to focus on non-functional performance testing which focuses on assessing the reliability of an application or a system. As we see that reliability and scheduling algorithms are closely connected, it would be very important to consider or evaluate how a scheduling algorithm works by providing different input data and by checking it against a set of parameters defined for reliability.

SOFTWARE RELIABILITY TESTING

Reliability in software is the probability that a software would work in a proper manner in a particular environment conditions and for a given amount of time. The following formula is used to find the probability of failure while testing a sample of all input states that are available[1].

Probability = Number of failing cases / Total number of cases under consideration

The reliability of software can be found by finding the output space from given input space and software.For reliability testing, data is gathered from various stages of development, such as design and operating stages.Due to time and cost restrictions,statistical sample are collected from the products to

Reliability Monitoring in Cloud:

While testing focuses on assessing the reliability of a cloud system before deployment of a cloud application and cloud computing servers/Infrastructures, monitoring helps in assessing the behavior of a system in real time in a continuous way.

IMPORTANCE OF SCHEDULING ALGORITHMS IN ENHANCING RELIABILITY

The efficiency of scheduling algorithm determines to which extent a system is reliable. The functioning of a scheduling algorithm determines whether the operation performed on a cloud system is reliable. The various scheduling algorithms that are used in this context is given below.

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Importance of API testing to ensure reliability

Cloud Computing can be applications that reside in datacenters as hardware or software in the huge data centers and could be the products or applications .[2]B.Li et al., explained the major characteristics of cloud computing as Socialization, intensification, and specialization are the three basic characteristics of cloud computing. Out of which, socialization is the behavior of cloud computing which showcase cloud computing as a computing model which provides various forms of cloud services resources like web services, application programming interface (API) which are leveraged as infrastructure as a service (IaaS), platform as a service (Paas), and software as a service (SaaS),As cloud computing has started to gain momentum, architects are looking for more ways to integrate their traditional application with the cloud model. The service providers in today's age have come up with predefined list of cloud APIs which can help anyone who wants to integrate their services in the cloud. As such APIs are not a new word in computing world. APIs in general are defined as a set of programming instructions and standards for accessing a Web-based software application or Web tool. A software company releases its API to the public so that other software developers can design products that are powered by its service. An API is not a user interface but a software-software interface. This enables applications to communicate with each other. In the connected world, although it may look like we are interacting with a single system; the main system would call or interact many other sub systems using API functional calls. An example to this would be when we purchase goods online, the only visible portal would be the online shopping portal, and this would interact with any other systems in terms of either providing data or receiving response to make each transaction successful. In essence APIs are one of main building blocks of non-standalone systems. As cloud computing deals with more of collaboration and socialization with different systems, Cloud APIs play a key role to integrate services in the cloud. In simple terms, the concept of APIs are nothing but a form of software as a service, in which a cloud provider enable users to leverage cloud computing in their systems through the list of APIs provided by the various cloud providers. With this introduction on cloud computing it would be the very important to ensure the APIs that are written or that which is used for integration does not compromise on quality and are completely validated before they are released to the market.

[3]Cretella, G et al., in the paper "Semantic Web Annotation and Representation of Cloud APIs " have presented an analysis of techniques that can be used for semantic description of Application Programming Interfaces exposed as web services through SOAP or REST based protocol.[4]Meng-Yu Wu et al bring out the importance of a strong API access control model for strengthening the security of cloud computing in the paper "Design and implementation of cloud API access control based on OAuth".Further Jenkins et al[4],have proposed a new framework which by itself a cloud application which contains plugins for testing APIs of cloud platforms. Reliability assurance can be made at the API level itself to ensure that the overall reliability of a cloud system can be strengthened.

Cloud APIs can be broadly classified based on the following types[5,[6],[7],[8],[9],[10],[11]

Classification based on the type of cloud services provided

1. *PaaS APIs (Service-level):This APIs help in deployment of applications in Cloud*
2. *SaaS APIs (Application-level):* These APIs are designed in such a way that they can be used as a standalone service for building any cloud application.
3. *IaaS APIs (Infrastructure-level):* Commonly referred to as Infrastructure-as-a-Service, these APIs help in rapid provisioning or de-provisioning of cloud resources.
4. *Cloud provider and cross-platform APIs:* As today's environment does not limits is usage with a single cloud provider, these APIs play a greater role in providing cross platform capability.

Classification based on the various initial conditions that can be subjected to an API

Each API will have a set of input conditions, based on that they can be classified as :
1. Mandatory pre-setters.->Requires few activities to be carried out before the API is called
2. Behavioral pre-setters->There could be optional parameters which might be set or not set before the API is called.

Classification based on the nature of the API

1. Operating System- API for MS Windows API for Apple Mac OS X (Cocoa)
2. Application Services API
3. Web Services API (REST or SOAP)

Classification based on the API declaration

1. APIs that do not belong to a class
2. APIs that belong to a class, but requires object to be created before API function call
3. APIs that can be only by using the class reference, but creation of object is optional.

Classification based on the API invocation

1. Direct API call
2. API call based on event trigger: E.g.,mouse movement/Mouse Click.
3. API call based when an exception occurs.E.g.,

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Classification based on the Parameter Passing

a. By value-The value is placed directly into the parameter list.
b. By reference->The pointer/address location of a variable is passed in the parameters list.

Classification based on Output of an API

c. Executes an operation an returns a value as an input for some other system
d. Update/Modify a registry or a resource
e. Performs an operation, but does not return anything.

Need for Testing Reliability in cloud:

As we see that testing reliability is very important in any software systems, need for testing reliability for cloud becomes the need of the hour. Cloudsystems have to be highly reliable in the sense that cloud has varied service provider and each of them have a varied need when it comes to reliability.

- IAAS reliability testing: This helps in provisioning of 100s of VMs in a particular point of time and reliability is an important factor to ensure seamless operation. Hence it can be said that there are various factors which attributes to reliability which needs complete validation before a system is erected.
- PAAS reliability Testing: This helps in deploying the cloud application. Even if the development and unit testing of a particular system has been successful, an application testing checked across various reliability parameters in a PAAS environment has to be validated to ensure that the application performance is reliable.
- SAAS reliability Testing:

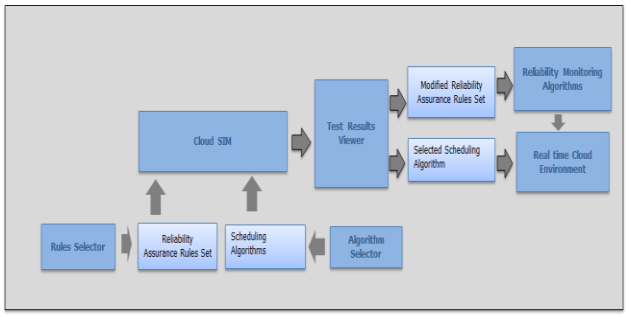
Related Works:

- Wenhao Li, Yun Yang, Jinjun Chen, Dong Yuan "A Cost-Effective Mechanism for Cloud Data Reliability Management Based on Proactive Replica Checking" IEEE/ACM proceedings Cluster, Cloud and Grid Computing (ccgrid), 2012.

- Iyer, G.N et alProposed an integrated, extensible Cloud test framework for testing various Cloud features, called Progress Cloud Test Framework (PCTF) and describe its components and characteristics

PROPOSED MODEL

When cloud computing is targeted to focus on enhanced collaboration and communication across various sub sytems,the need for scheduling algorithm play a major role in cloud provisioning. The proposed model helps in testing a set of scheduling algorithm using the cloud modeling environment Cloud Sim.Further the opted scheduling algorithm can be migrated and the rules set used for testing the cloud behavior in simulation environment can be used to monitor the reliability in real-time environment.



CONCLUSION

We have seen in this paper the basics on the importance of reliability in any cloud environment. Also the various APIs available in any cloud environment is explained to ensure how reliability can be strengthened at the API level itself. Further a model architecture is proposed which can be used for an integrated and unified approach that can be adopted while testing any cloud environment.

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