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Knowledge Based Service Diagnosis System

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ABSTRACT
Cloud Computing is emerging out as a powerful, service-oriented computing paradigm today essentially because of its dynamicity. The applications that are hosted on the cloud are characterized by loosely coupled services working in conjunction to provide the desired functionalities. For ensuring business continuity, such applications need to adapt to the rapidly changing requirements. A major challenge is to provide high Quality of Service, for which, a process-based approach called Information Technology Service Management is used. This paper presents a automated service diagnosis approach in a cloud environment so as to ensure greater reliability and faster recovery from problems without any human intervention.
Keywords:- Automation, Cloud Computing, RESTful web services, Service based applications.

I. INTRODUCTION

In cloud computing environments, applications are provided in the form of loosely coupled services to the customers. Such applications completely rely on these underlying IT services. Although these services are separated by their varied applicability, the one thing they share in common is their dynamic nature which gives rise to an important challenge of managing these services effectively during the run time so that they can adapt to the changes in business environments and efficiently address the new user demands. The traditional approaches of quality assurance during the development phase need to be replaced by new ones so as to ensure lesser operation time and better quality of service.

IT Service Management (ITSM) aims at providing services and reliable support allowing smooth functioning of organization's business processes [1]. The major intention behind this approach is to change the perspective of looking at IT infrastructure as a group of services on the whole rather than individual software / hardware components. The main aim here is to ensure the alignment of IT operations with the business processes so as to ensure smooth operation. In the event of any problem that is reported by the monitoring server, human expertise and intelligence is needed for analyzing the problem and reaching to the root cause of the problem. Based on this analysis, decision is made and the necessary action is taken to correct the problem detected.

Now, considering an actual runtime scenario on a very large scale, the dependence on human intelligence is a huge risk. This is because there is a chance of human-errors which cause delays in taking action against the detected problem. Such delays cause a great risk to the business relying on these services and might even cause huge loss to business operations.

The idea is to design a system with self-healing capability which can make human-like decisions in no time and possibly solve problems that are detected. The automation of the service diagnosis process will ensure better support and management of services on a large scale. So, this work focuses on building such a system wherein monitoring, decision making and problem fixing can be totally automated thereby saving the most important resource that is time.

II. MOTIVATION

In a practical scenario, any application being hosted on a cloud is constantly monitored for its behavior and performance so as to make the system highly reliable and provide quality support, if needed. Usually, the reports generated by a monitoring server are very large with a lot of events logged. It is both tedious as well as time consuming for a human to analyse the reports, realize & identify a problem (if any) and then find a solution for the problem identified. These problems may be vital and may require immediate attention so that it avoids any disruption of service provided to the end user. A human-error or a delay may result in further problems and thereby might cause a great loss to business. The idea here is to automate the above process & save time by providing immediate solution to the problem identified so that the system becomes more robust and reliable, without even disrupting the current state of operation of the system.

A. Literature Survey

Over the last decade, a lot of work has been done on designing and developing systems that provide effective service management for fault detection and monitoring. Most of this work focuses on detection of faults in a service.

Pereira E. and Pereira R.[2] focused on service failures in context to web services. Web services provide means of web communications between applications for providing greater

availability. In such a context where multiple services depend on each other to deliver a single utility to the end user, any event of failure in a specific service or even performance degradation could greatly affect the user's experience. The work done discussed the issue of service failure detection and replacement focusing on the time of replacement and the frequency of failure.

Katsaros G., Kubert R. et al.[3] explained a monitoring framework. With the advancement in technology, virtualization came into existence gradually. The work presented here focuses on building a service oriented monitoring framework using REST that monitors and reports faults in physical and virtual infrastructure.

Cuiting Chen, Gross H.G. et al.[4] presented a novel approach to improve monitoring. Service oriented architecture is an architectural pattern in which loosely coupled services work together to provide some functionality. These architectures support runtime evolution of software through reconfiguration of misbehaving services. A novel method was presented to improve service diagnosis by monitoring not only the services but also the invocation links between these services. This work shows to what extent the service diagnosis can be improved by inclusion of invocation links in monitoring.

Adrada D., Salazar E. et al.[5] approach discussed here addresses the problem of monitoring converged services. Converged services can be thought of as an integration of traditional telecommunication services and web services. This paper focuses on the new challenges that converged services face from their management perspective.

All the above work has made an important contribution towards providing a better service management by improved monitoring and fault detection. However, each of these approaches still require human intervention at some point for service management. The work done in this project is an attempt to build a system which will monitor, detect problems, analyze them, provide a solution to it at run-time and correct the problem.

III. PROPOSED WORK

The proposed system involves two major components: A service monitoring system and a knowledge based automation system. The integration of these two components together can help to achieve an improved service diagnosis of problems and thereby provide effective service management.

The knowledge based analysis component is the heart of this system. It essentially uses the knowledge available with for diagnosis of a problem, investigates it, finds the root cause and builds a solution to fix the problem. The main job here is to make human-like decisions based on the knowledge available so that the problem is corrected in an automated manner in minimum time.

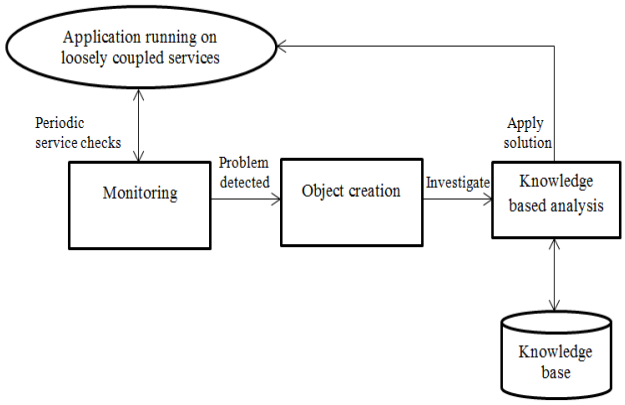

Fig. 1 System Architecture

As the above diagram illustrates, periodic service checks are configured to continuously monitor the functioning of services. If some misbehaving or underperforming service is identified, then an object is created for the problem identified and it is fed to the knowledge based analysis system. Here, if sufficient knowledge is available, then the problem is investigated for the root cause of the problem and a solution is built to fix the problem. This solution is in the form of set of activities/commands to be triggered on the specific node on which the misbehaving service was identified. It is generally a script that is to be run on the desired node. All the data required to perform any action on that specific node is already gathered from the monitoring information. Node is of one of the following types: Machine/Application/Resource/Software. Based on what level the problem is identified, accordingly the action is triggered to fix the problem. As soon as the misbehaving service is up and running, the monitoring system detects it and accordingly triggers an action to delete the object that is created for the problem that was earlier identified.

Thus, in this way an overall effective system is established by adding decision making capabilities to the monitoring system which would allow for a knowledge based automation of service diagnosis and thus provide a better service management.

IV. EXPERIMENTAL SETUP

The tools identified and used to implement the proposed hypothesis are: Nagios (monitoring system) and AutoPilot (Knowledge based automation system).

Nagios [9] is a widely used monitoring system in the IT industry today. It is an open source infrastructure monitoring system which enables organizations to identify problems. Individual hosts and service definitions are defined in the Nagios configuration for client machines and the services running on them respectively.

AutoPilot [10,11] is a knowledge-based system which aims at automating enterprise IT by dealing with the system operation tasks. It works by dynamically finding out solutions for performing some tasks based on a knowledge pool. The idea of automation used here is that a machine should perform tasks that usually humans do, because human‟s time, is the only limited resource and it should be spent more effectively. Autopilot defines 22 generic Knowledge Items (KI‟s) which are represented in the form of a knowledge graph. From this pool of knowledge, Autopilot constructs solution in a step-by-step manner for any given issue/task. It is capable of giving a service-independent solution as it gets to the root cause of the problem rather than solving it at a higher level. Thus, such a knowledge-based system can help for a better and faster service diagnosis.

By coupling the Nagios and the Autopilot system together, an automated service diagnosis system can be created which can detect a faulty service and define a possible solution to fix the fault within a minimal amount of time.

V. RESULT

The knowledge based diagnosis system is tested for monitoring of a database server. The system is tested for performance of the server and test results indicate that a considerable amount of diagnosis time is saved. The following graph clearly depicts the benefits of automated service diagnosis over the manual diagnosis:

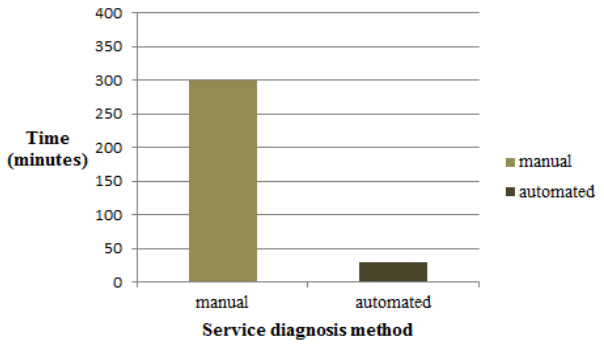

Fig. 2 Traditional Service diagnosis vs. Automated Diagnosis

The time benefit of using an automated service diagnosis clearly indicates the business value provided by this system. In the manual approach, the support personnel requires hours to solve a problem identified. On the other hand, an automated system takes decision on its own and fixes the problem in hardly a matter of some minutes.

VI. CONCLUSION

Most of the cloud applications are build using loosely coupled services or remote services provided by cloud. The IT Service Management approaches are used for ensuring higher Quality of Service. In this paper, an automated diagnosis system is proposed in order to ensure faster recovery from problems and provide high reliability.

With the power of automation added to the diagnosis of service based applications running in a cloud environment, a highly reliable diagnosis system is developed which provides recovery from problems in considerably lesser amount of time when compared to manual approach.

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