CHALLENGES IN BACKING UP AND RESTORING ENTERPRISE APPLICATIONS

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ABSTRACT

Backing up and restoring enterprise applications (EAs) are essential operations that are usually done manually by an administrator or semi-automatically by tools. Backing up an enterprise application (EA) consists of backing up all its components together with the environments and operating systems in a consistent way so that the application can be restored and function properly later. There are many challenges for backing up and restoring EAs. This paper proposes a framework for automating the process of backing up and restoring EAs deployed in a cloud environment to ensure the continuous running of these enterprise applications and prevent the loss of data in case failure of applications

Keywords: Backup, Cloud Computing, Enterprise Application, Restore.

I INTRODUCTION

Enterprise Applications (EAs) [1] are now known as complex, scalable, distributed, component-based, and mission-critical applications to solve an enterprise-wide problem. From physical view, an enterprise application (EA) can be composed of three principal components: application code, database and static resources that are usually deployed in different machines to increase throughput of an application. In addition, each component needs an environment on which it is deployed. For EAs developed based on J2EE platform1, their application codes need a Servlet container such as Tomcat2 to operate. Application database has to be manipulated by a database management system (DBMS). Static resources of application (uploaded files) need a file server to manage them. Therefore, backing up an EA consists of backing up all its components together with the environments and operating systems in a consistent way so that the application can be restored and function properly later. Backing up and restoring applications are usually done manually by an administrator or semi-automatically by tools. There are many challenges for backing up and restoring EAs. It takes a lot of time for an administrator to backup all components of an EA. To decrease the effort of backup, administrators often backup only critical/core components of an EA such as application database. Many solutions mentioned [2] to help administrators to back up mainly application databases. Frequency of backup is not high. It increases a risk of data loss. It takes a lot of time to restore an application because many application's components have to be reinstalled from the crash. Recently, cloud

computing paradigm [3] has made a significant change in the way of deploying applications. Virtual machine (VMs) provisioned from the cloud can be used to deploy applications instead of traditional physical servers

II CHALLENGES IN BACKING UP AND RESTORING ENTERPRISE APPLICATIONS

Backing up an EA is a set of operations to create a copy of the application and store the copy in a secure storage device. Reversely, restoring an EA is a set of operations to reconstruct the execution of the application from a copy of the application. Executing of an EA can be constructed from six components such as application code, runtime environment, application database, database management system (DBMS), static resources and file service. Backing up an EA therefore requires that all components belonged to the application have to be backed up. Each component can be planned to be backed up at different points of time. A backup version of an EA therefore is a set of backup versions of its components. Restoring a backup version of an EA can be done by firstly finding a set of backup versions of its component, then doing the restore of backup versions of each component. Backup and restore are essential operations to enhance the availability of an application in preventing hardware failure and ensure security of application data. Backing up and restoring EAs are complex operations taking a lot of time and effort of administrators. Many backup and restore solutions are proposed [6]-[9] to automate backup and restore operations. However, these solutions mainly focus on backing up application databases. The other components of the application have not been considered. Recently, cloud computing paradigm allows to deploy applications on VMs that can be backed up and restored easily and quickly. Snapshot mechanism supported by the cloud platform can be used to create an image file that backups the current state of machine including state of applications running on that machine. The image file can be used to restore the VM later. Although the snapshot is considered as a powerful mechanism to backup and restore applications deployed in a cloud environment, there are still issues that snapshot mechanism has not resolved. For application components that change rapidly and frequently such as database components or static resources, snapshot cannot be done every minute to prevent the risk of losing data that are created or modified between the two success snapshot. In addition, snapshot mechanism is not responsible for creating backup versions of an application that composes from snapshots of many VMs. Snapshot also lacks mechanisms that monitor the executing status of application components to detect failure of components needed to restore automatically. Therefore, the next section will propose a framework that automate operations of backing up and restoring EA deployed in a cloud environment.

III FRAMEWORK FOR AUTOMATING OPERATIONS OF BACKING UP AND RESTORING

Enterprise Applications Deployed in Cloud Environment This section will discuss a framework for automating operations of backing up and restoring EAs that are deployed in a cloud environment providing Infrastructure as a Service (IaaS), particularly for private cloud built form open source cloud management platforms such as OpenStack [8], OpenNebula5, Eucalyptus6 and CloudStack7. As discussed in previous section, an EA may have many backup versions. The proposed framework in this paper is limited to backup and restore the most recently version of an EA.
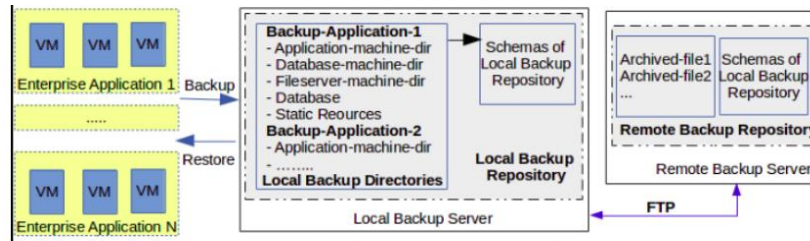
Fig. 1. Proposed framework for backing up and restoring EAs on cloud environment.

The proposed framework, as described in Fig. 1, requires that several VMs are reserved for each EA to deploy its components. A VM cannot be shared between two or more EAs. There are three types of VMs such as Application machine, Database machine and File server machine that host correspondingly application code components, application database components and static resource components of EAs. One machine (virtual or physical), so called Local backup server, located in data center hosting cloud environment where EAs are deployed is used to manage Local backup repository. Another machine located on the site that is a far way from the current data center will play the role of Remote backup repository.

IV MECHANISM FOR BACKING UP ENTERPRISE APPLICATIONS

Local backup of an EA consists of five operations. Operation 1, Backup application machine, creates a snapshot of application machine and stores its image file into Local backup repository. This operation is responsible for backing up application code component and its runtime environment (operating system, middleware, libraries,..). Operation 2, Backup database machine, creates a snapshot of database machine and stores its image file into the Local backup repository. This operation is responsible for backing up database management system and application database component. Operation 3, Backup file server machine, creates a snapshot of file server machine and stores its image file into Local backup repository. This operation is responsible for backing up file service component and application static resources component. Operation 4, Backup application database, creates a new revision for the application database component and stores it into Local backup repository. This operation should be performed more frequently than the first three above operations to prevent the risk of losing data. Operation 5, Backup application static resources, creates a new revision for application static resources component and store it into Local repository. This operation also should be performed more frequently than the first three above operations to prevent the risk of losing data.
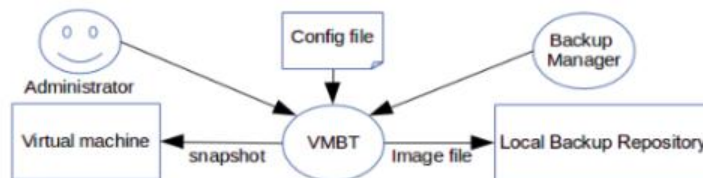

Fig. 2. Mechanism of virtual machine backup.

In terms of backup mechanism, the first three operations have the same mechanism. This is the snapshot mechanism supported by a cloud platform providing IaaS. However, a method for naming snapshot files in local repository should be defined to distinguish the backup of different machines and to distinguish different backup version of the same machine. We use notion Virtual Machine Backup to mention the backup mechanism for the first three operations.

V MECHANISM FOR BACKING UP VIRTUAL MACHINES

Fig. 2 presents a mechanism for backing up VMs. Virtual Machine Backup Tool (VMBT) maintains a list of identifiers of VMs that need to be backed up. VMBT can be called by application administrator or by Backup Manager. In fact, VMBT is only called by the application administrator whenever the application is upgraded or reconfigured.

VI MECHANISM FOR BACKING UP APPLICATION DATABASE

Fig. 3 presents a mechanism for backing up application database. Usually, database management system creates log files to record all transactions occurred in its databases. DB Backup Agent uses these log files to create Datalog files that can be used to restore a database later. Datablog files are stored in a DB cached directory on the database server machine. In Local backup repository, a DB backup directory for application database is created. RSync client and Rsync Server are configured to synchronize the content between DB cached directory and DB backup directory. The Timer is set to launch Rsync Client periodically so that Datalog files in DB cached are backed up into DB backup directory.
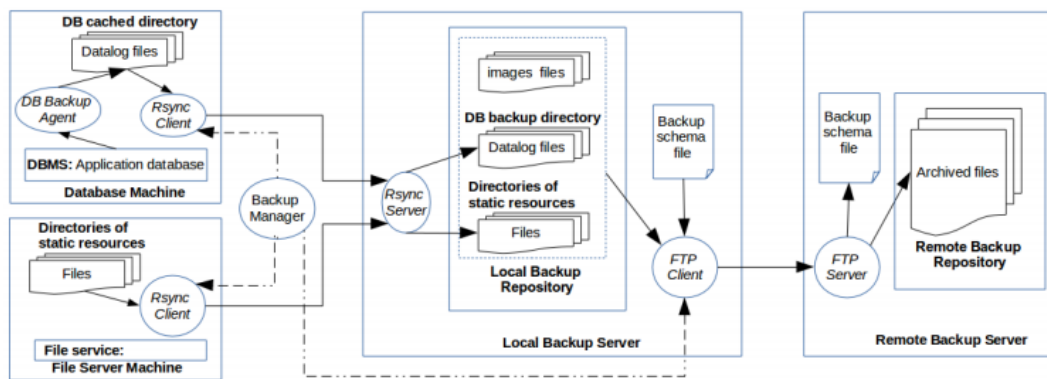
Fig. 3. Mechanism for backing up database and static resources of an EA.

VII MECHANISM FOR RESTORING ENTERPRISE APPLICATIONS

Mechanism for local restoring enterprise applications: Restore Manager in Fig. 4 will monitor the executing status of application components. When Restore Manager detects that a machine belonged to the applications was fail, depending on the type of the machine, Restore Manager will launch an appropriate process of restoring
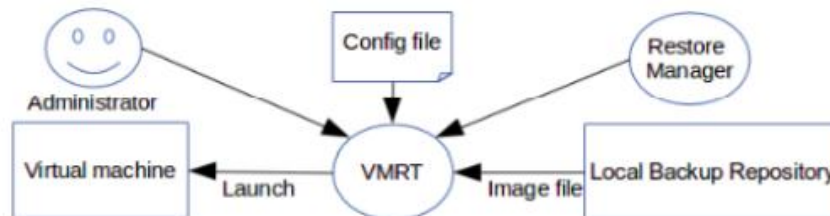

Fig. 4. Restore a virtual machine from Local backup repository.

This process is started when Restore Manager calls Virtual Machine Restore Tool (VMRT) with the identifier of the machine that need to be restored. VMRT will contact Local Backup Repository to find out the image file of the machine and launch an instance of this image file. If this is an application machine, the process of restoring is finished. In case of a database machine, the Rsync Client on the machine is set to be launched automatically to connect to Rsync Server to restore Datalog files from the DB backup directory to DB Cached Directory as described in Fig. 5. Then DB Restore Agent will update the application database with Datalog files in the DB Cached Directory. If this is a file server machine, the Rsync Client on the machine is set to be launched automatically to connect to Rsync Server to copy files from Directories of static resources to Directories of static resources.

VIII MECHANISM FOR REMOTELY RESTORING ENTERPRISE APPLICATIONS

Firstly, the administrator uses an FTP client to connect to FTP server on Remote backup machine and download image file of Local backup server to the cloud environment as described in Fig. 5. The administrator then launches Local backup machine from this image file. Remote restore agent will be executed automatically on Local backup machine. It connects to the FTP server on Remote backup machine and download Backup schema file. By analyzing the content of the file, Remote restore agent will download all backup files stored in Remote backup repository, decompress them to restore the content of Local backup repository. The administrator then executes Application Restore Tool to restore an EA from Local Repository, as described in Fig. 6. Based on the schema file, Restore Application Tool can know how many applications backed up in Local Backup Repository, how many VMs belonged to an application and which image file belongs to a VM. To restore an application, Restore Application Tool call Virtual Machine Restore Tool (VMRT) with identifiers of all machines belonged to that application.

IX CONCLUSION

Works Backup and restore are essential operations to ensure the continuous running of an application and prevent the loss of data in case failure of hardware. This paper presented a framework for automating operations of backing

up and restoring EAs that deployed in a cloud environment. The proposed framework is based on 3 principal mechanisms: mechanism of backing up and restoring VMs hosting EAs, mechanism of backing up and restoring a database of EAs and mechanism of backing up and restoring static resources of EAs. With proposed framework, all components of an EA are backed up in a consistent manner. Backed up data are not only stored on a local repository located in the same location with the application, but also stored in a remote repository located at a location far away from the application site. Restore mechanism proposed by the framework can detect and restore automatically an application component that was fail to ensure the application continue to function. The experiment proved that the proposed framework is feasible. However, the implement should be improved so that it is easier to integrate the backup and restore mechanism proposed by the framework into an EA.

REFERENCES

[1] Fowler, M., Rice, D., Foemmel, M., Hieatt, E., Mee, R., & Stafford, R. (2002). Patterns of Enterprise Application Architecture. Addison Wesley.

[2] Badhel, S. P., & Chole, V. (2014). A review on data back-up techniques for cloud computing. IJCSMC, 3.

[3] Mell, P., & Grance, T. (2011). The NIST Definition of Cloud Computing, Recommendations of the National Institute of Standards and Technology. NIST Special Publication, 800-145.

[4] Staimer, M. Storage snapshot technologies in data backup and recovery. From http://searchdatabackup.techtarget.com/tip/Storage-snapshot-technologies-in-data-backup-and-reco very

[5] Preston, W. C. Using snapshot backups to replace your traditional data backup system. From http://searchstorage.techtarget.co.uk/feature/Using-snapshot-backups-to-replace-your-traditional-da ta-backup-system

[6] Javaraiah, V. (2011). Backup for cloud and disaster recovery for consumers and SMBs. Proceedings of IEEE 5th International Conference on Advanced Networks and Telecommunication Systems (ANTS) (pp. 1-3).

[7] Akkuş, I. E., & Goel, A. (2010). Data recovery for web applications. Proceedings of IEEE/IFIP International Conference on Dependable Systems & Networks (DSN).

[8] Sharma, K. & Singh, K. R. (2012). Online data back-up and disaster recovery techniques in cloud computing: A review. International Journal of Engineering Research and Applications, 2(5).

[9] Vora, S. B., & Anandache, J. G. (2014). Data backup on cloud computing technology in digital libraries perspective. Journal of Global Research in Computer Science, 5(2)