A Comprehensive Analysis of Agent Based Backup Management System

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Abstract— Mobile Agents are set of programs which are used for several purposes at network. Software agents are installed permanently within a Network on each source system in which to perform backups. To enhance the performance of the system as well as reduce the computational cost, agents based techniques are used nowadays. To perform Backup Disaster Recovery (BDR), that is a predefined feature in the configuration as agent, recently performing three types of the backup management, i.e. Full, Incremental and Image Backups. To facilitate the forth coming researchers we have done a comprehensive study on agent based backup management systems. This paper discussed almost all relevant techniques along with their pros and cons and also highlighted the potential research gaps. We are confident that this study will be a useful material for the researcher to find out their problem statement.

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1. INTRODUCTION

Mobile agent attracts researchers in the field of software engineering and artificial intelligence. An Agent is independent software program that executes on the behalf of user. Mobile Agent has ability to travel on multiple Nodes in the Network for collecting information or transporting request. The Agent Movement Increase the performance and generate the dominant computing environment. A software structure is programed in Agent that delivers the security and data protection. This infrastructure consists on rules, Protocols and direction on which Agent will move. Mobile Agent is very simpler, faster, and consumes minimum resource utilization.

David Kotz et al., 2002 define the utilization and importance of Mobile agent in different fields. Data is very important for any organization. Moreover latest and correct data is an expensive asset for any organization. Database security is very sensitive issue in the field of business Management and its backup strategies require more efficient and secure methods. Different Authors introduce different type of backup procedure depending on their requirements like Full Back up, Incremental Backup and Image copy management system.

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Different type of backup management systems has been deployed in many organizations. An Agent based system can be implemented with any client/server technology, there is difference between traditional client/server system and agent based system, because there is no distinction between a client and server in agent based system. All agents perform their role according to the instructions assigned by the designer or agent designer [1].

Nisha et al., 2010 proposed a model for crawling of Mobile Agents. Mobile Agents are energetic software entities that travel independently in a network to achieve tasks on behalf of initiator. Now a day, web crawler uses the basic method of Mobile agent to increase their moving speed. Mobile Agent migrates from one machine to another machine in different networks. Mobile agents are transmitted to remote web server for local crawling and processing of web documents and then return either back to search engine or to the next web server for further crawling[2,3].

Willim M Farmer et al., 1996 Web Crawler robotically find information from the World Wide Web and this network load can be reduced by using the mobile agents [4].

A Mobile agent is self-governing entity which is independent from the system. It is not limited to the system in which it starts execution. The major ability of an agent is to move itself from one system to another in any network and be executed there. The analysis part of the crawling process is done locally rather than the remotely which reduce Network Load and traffic and as a result performance and efficiency become increase of

crawling process [5, 6].

There is still more work is needed to take the full advantages of Mobile agents. Mobile Agents gave a very positive role in the field of research due to their different type of unique features like mobility, security and reliability of data by using some error recovery method/framework. Research Activities based on Mobile Agent are increasing rapidly and are applied in big domain area. By adopting Mobile Agent approach can overcome the weak connectivity between client and server. Multiple Transactions can be communicated to multiple Agents which can execute in parallel to expedite the execution efficiency [7]. Mobile Agent will automatically update or insert as any change occurs or new record is entered in database from any client in the database.

Mobile Agents play important role in distributed information retrieval, Network Management, e-commerce and etc. Especially information retrieval from huge distributed heterogeneous database is a big stage for Mobile Agents [8].

2. RELATED WORK

Hanjuan Jin, describe Mobile Agent is a software concept that can move throughout the Network. The Basic purpose of Mobile Agent is mobility of data. Mobile agents have a great contribution in the field of Mobile data Computing, Electronic Commerce, Networking, Data Ware Housing, Manufacturing and Scientific Computing. Applications which are using Mobile Agent technology use the network transparently and avail full advantages of the local resources. The execution of the process is done at destination rather than remotely accessed. Agents transfer the user's identifications which are authenticated during execution at each node in the network. Agents and their data are fully encrypted for the security of data [9, 10, 11].

Yashpal et al., 2012 worked for Mobile. Agent is very intelligent and fast way of communication mode between different nodes at any network (LAN (Local Area Network) and wireless Network). Before mobile agent technique is introduced, communication between server and client by different approaches for example Remote Procedure Call (RPC) and Remote Evaluation (REV) were used. In RPC technique, clients send the data to the server and procedure executed there and then results send back to the requested client. While in REV approach, which is different from RPC, procedure sends itself and sends the result to the client. But there is a drawback that mostly network connection become lost during the communication. Mobile Agent solves this issue

because agent is not dependent on the server operation. Whenever the mobile agent transfers data from client to the server then network connection becomes disconnected and agent performs its task at server side and when it is finished, it reconnects the client with the server. This method of communication consumes very less bandwidth of the network especially in the wireless environment where disconnection is frequent [12, 13].

S. A. Arekete et al., 2013 designed a Mobile Agents are very useful for observing the activities of users in network. These activities can be local on their desktop system or at the internet. Mobile agents face security threats from malevolent host. Mobile agents have these source commands and know where and which commands should be executed. It can communicate with other agents as well as the host on the network. Agent has intelligent commands which help the agent to sense the environment and activities of the network as well as to achieve its goals [14, 15, 16].

Seifedine Kadry et al., 2010 introduced a new technique that maximum DBMS has the capability to take backup and restore the available database. Suppose there is transactional distributed data base and suddenly database is corrupted or crashed due to any reasons during work then all transactions will be lost and if this data base contains any sensitive data then we cannot examine that how much valuable data we lose due to any reasons. Every DBMS has the capability to take back up and restores jobs which enable us to access our old data at any time we need. An author introduces the new technique which will save the backup files as an XML document which makes it very simple and reliable [17, 18].

Pratap P.Nayadkar et al., 2014 define various backup and restore techniques in different mobile systems. Backup is a critical task nowadays. Data may be lost due to software failure, hardware or human error. Backups are even more important because these devices like laptops and smart phones might be damaged or lost or theft. Then data security is very important in mobile devices as compared to the data Backup in Computer systems. Mobile devices face many challenges regarding backup because many mobile phones or smart card connect to internet and data may be transmitted to the cloud computing paradigm which is more reliable and cheapest by end users. In this paper several backup and restore techniques will be introduced, which provide the security of data at transmission level. Backup can be categorized in several types such as Full Backup & Incremental Backup. According to literature

review, data is stored in a file based or device-based style and data Management is categorized as on-line or Off-line. These data Management types depend upon accessibility, security and cost. There are two broad types of backups, On-Line Backup and Off-Line Backup. In Online backup technique, data is saved and restored while system is running whereas in Off-Line Backup it is vice versa. Study says that On-Line Backups are more useful than Off-Line Backups. In this Paper Author use the encryption technique AES 128 Algorithm, which is unbreakable and file is generated after backup as database file [19].

Syouji Nakamura et al., 2013 introduced different backup methods for data bases, Full back up, Incremental, Image copy Method. This paper applies cumulative damage model for backup of files in a database system, by putting damage shock by update, failure shock by database failure and damage by dumped files, and considers the trade-off among overhead costs of image copy and incremental, full back up methods [20, 21].

Manali Raje et al., 2012 presents the backup of data on remote server and then server become intelligent, particular server itself will give better solution for backup and restoration using cloud technologies. Different users can get the data from the virtual place according to their requirements / needs. In Cloud Computing technology, Data Server handles the huge amount of data. Author

describes the Seed Block Algorithm which is responsible of data back from storage. Data which is permanently lost can be retrieved from this algorithm even in the absence of Network Connectivity.

Agent can be classified into two categories depend upon the movement i.e Weak Migration is the ability of an agent to travel over a network, which only moves the instructions and some partial execution state. The weak migration scheme is less clear then the strong migration. Strong Migration is the ability of movement of an agent in the network, in which Agent move with code and execution state. The agent is deferred, clarified, and transferred. Strong Migration can overcome the disadvantages of weak migration. This is due to taking more execution state and marshalling and transfer of the state over a network required heavy processing.

Data backup is crucial for daily life operations. This process creates a copy of current data and stores it at another location. A backup is a file that consists of all data which is to be saving, and how it was arranged and stored for further access. Backup can be stored on an external hard drive or in the clouds. Backup can be accomplished manually but in resourceful environment automates this process and backup incrementally [22, 23, 24].

TABLE-1: BROAD RESEARCH ANALYSIS OF MOBILE AGENT

Sr. No	Paper Ref. No	Mobile Agent	Multi-Mobile Agent	Mobile Agent Security	Backup	RAID
1	[1, 2, 3]	✓	✓	✗	✗	✗
2	[4, 5,28]	✓	✓	✓	✗	✗
3	[6, 7,27,31]	✓	✗	✓	✓	✗
4	[8, 9, 10]	✓	✗	✓	✓	✗
5	[11, 12]	✓	✗	✓	✓	✗
6	[13, 14, 15,29,30]	✓	✓	✓	✗	✗
7	[16, 17, 18]	✓	✗	✓	✓	✓
8	[19,20,21,22,23,24]	✗	✗	✗	✓	✓
9	[25,26,32]	✗	✗	✗	✓	✓

TABLE-2: TECHNIQUES USED IN MOBILE AGENT

Paper Ref. No	Technique	Mobile Agent	Monitor	Light Weight	Updating	Modification
28	JAVA Frame Work	✓	✓	✓	✗	✗
27	Mobile Cryptography	✓	✓	✓	✗	✗

5	Crawler	✓	✓	✓	✗	✗
29	НОП-calculus	✓	✗	✓	✗	✗
5	ACMAS (Application Centric Mobile Agent Systems)	✓	✓	✓	✗	✗
7	Three-tier (3TC) commit protocol	✓	✗	✓	✗	✗
19	Incremental Model	✗	✓	✓	✗	✗
19	AES Security Technique	✓	✓	✓	✗	✗
22	Seed Blocked Algorithm	✓	✓	✓	✗	✗
20	Cumulative damage model	✓	✓	✓	✗	✗

TABLE-3: BROAD RESEARCH ANALYSIS OF MOBILE AGENT

Techniques/Methods/Protocols	Advantages	Disadvantages	Remarks
Different Type of Frame Work discussed like Aglets, Concordia, Mole and Voyager. Java Frame Work Constructed [28].	Code Mobility is possible thorough a Language DiTyCO	Architecture is not discussed of any mobile agent.	Comparison of any mobile agent.
Mobile Cryptography [27]	Security solution which protects both the mobile agent and host resources	Protection is provided through standardize method rather than digital Signature.	Modification, Updating and Deletion
Aglet a library written in Java support by IBM for Mobile Agent [29].	Improve the Performance and efficiency of Crawling Process as compare to traditional Crawler	Time Consuming because Web Crawler will crawl through out all web Pages that have not been modified Last time.	There should be some mechanism which marks the Websites or Pages where changes occur.
Security Enhancement [4].	Attack Prevention on Mobility	Scale ability w.r.t. Distributed System.	Enhancement Required wr.t. Scale ability
Performance verification with НОП-calculus [29].	Ideal result with limited tool	Limited Verification used	Comprehensive analysis required
ACMAS (Application Centric Mobile Agent Systems) [30].	Lighter framework in the context of Network Management	Dynamic Management	Can use Off-the-Shelf-tools
Decentralizing Network Monitoring and management [31].	Optimize SNMP and CMIP with enhancement of Quality of service and Reliability	Limited for heterogeneous environment.	Decentralizing Network

Calculation the load overhead of Mobile Agent [14].	Monitoring and evaluation of activities	User privacy.	Does not maintain Security
Three-tier (3TC) commit protocol for distributed transactions [7].	Enhance 2PC with 3TC	Compare only with 2PC rather than other	Concrete Analysis is required.
DDTMM (Distributed database transaction management model) and Distributed Transaction decomposition and path planning rule [8].	Reduce Data Traffic in Distributed transactions	Performance of the proposed model has been presented instead of comparison	Comparison of other models is required
Scheduled Backup System with Incremental Model through AES Security technique [19].	Reduce bandwidth and increase the performance of the data	Platform Based Solution	Comparative analysis
Cumulative damage model [20].	Damage shock by update, failure shock by data- base failure and damage by dumped files.	Should be some mechanism which identifies the only Updated Files.	Consider the model where the backup of only newly updated files is made
Seed Blocked Algorithm [22].	Flexible, Portable, Fast ,User Friendly and Reliable.	Security Issues	There is no comparison of Seed Blocked Algorithm with other Algorithm.
EXOR [32].	Retrieved the Data even the files are deleted or Main Cloud is crashed.	Security and Validity of Data.	Any technique through which data is transfer to Clouds.
Different Data Base Management System (DBMS) [17].	Multi-application entertainment Environment/Interface.	Auto Task Scheduler. 2.Multiple Data Base Support 3.Multi Session Restoration	Light weight , Real Time , Chances of losses of data due to schedule backup.

3. DISCUSSION

In the above table different authors use different techniques and achieve targets through Mobile agents in various fields of research. Mobile Agents used in network for monitoring the Activities of users, Managing the traffic in the Network and improving the reliability and quality of services, Distributed database access on the internet and distributed Transaction of a distributed Heterogeneous database System. Mobile Cryptography is used for security purpose. Different author used the different Platforms such as Aglets, Concordia, mole and Voyager in the context of Network Management.

4. CONCLUSION

Data security and Correctness of Data is very important for any organization. This paper presents a comprehensive analysis in table-1 about the usage of mobile agents and their applications in various fields of research. There are some gaps regarding usage of mobile agents in the field of data Base Backup Management Systems. Different researchers use different methods to reduce the computation cost and transactional cost while moving the time data from one place to another place.

Computational Cost is very important factor in the context of Data Base systems when there is huge data as well as the data is going change rapidly like banking system, IT-Organizations or some organization where data change frequently. Availability of latest and fresh data without any wastage of time is only possible through Mobile agent, that is very light weight and frequently can move the set of instructions from one place to another place.

This paper gives a complete analysis and techniques which is already discussed for data base backup management system. It also gives a

unique idea to researcher which is very light weighted and helpful for this purpose.

The purpose of this survey is to introduce light weight backup systems which can immediate update the changed information on backing storage. The goal of this study is, user can get the immediate updated information. The proposed solution will take the real time back up, whenever a record or field information is changed at Client side. In the light of the previous conducted research, the proposed solution will be sufficiently contributed in minimizing the computational cost as well as maximizing throughput of the system.

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