DATA DEDUPLICATION IN THE CLOUD USING ENHANCED OWNERSHIP AND RETRIEVAL MODEL

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Abstract

Data de-duplication is one of important data compression techniques for eliminating duplicate copies of repeating data, and has been widely used in cloud storage to reduce the amount of storage space and save bandwidth. To protect the confidentiality of sensitive data while supporting de-duplication, the convergent encryption technique has been proposed to encrypt the data before outsourcing. To better protect data security, this paper makes the first attempt to formally address the problem of authorized data de-duplication. Different from traditional de-duplication systems, the differential privileges of users are further considered in duplicate check besides the data itself. This paper proposed to POR and POW schemes in secure enterprise cloud data de-duplication process.

Keywords: ***De-duplication, Schemes, Cloud, POW, POR, Efficiency, Redundancy.***

1. Introduction

The secure enterprise data de-duplication exhibited in this Chapter is an instance of the plan proposed as in it centers around the structure of an enterprise demonstrate where it is accepted that distinctive enterprises running a similar sort of business can utilize a single cloud, and every one of these enterprises has its own internal clients. The clients belonging to a given enterprise store their data in the cloud using the enterprise server. A two-levels data de-duplication conspire is introduced: one at the enterprise level, and the other at the CSP level. At the enterprise level, every individual enterprise plays out its own data de-duplication among its clients. At the CSP level, a second data de-duplication is performed on the data presented by the diverse enterprises to the cloud. As far as anyone is concerned, no earlier work has been done that bargains with ensuring the security of data de-duplication in the cloud using an enterprise display where cross client and cross-enterprise data de-duplication are both integrated. The value of the proposed model is that it tends to be helpful for little or medium size enterprises that don't have an immense number of assets and that intend to utilize these assets for other internal calculations or tasks rather than for capacity reason.

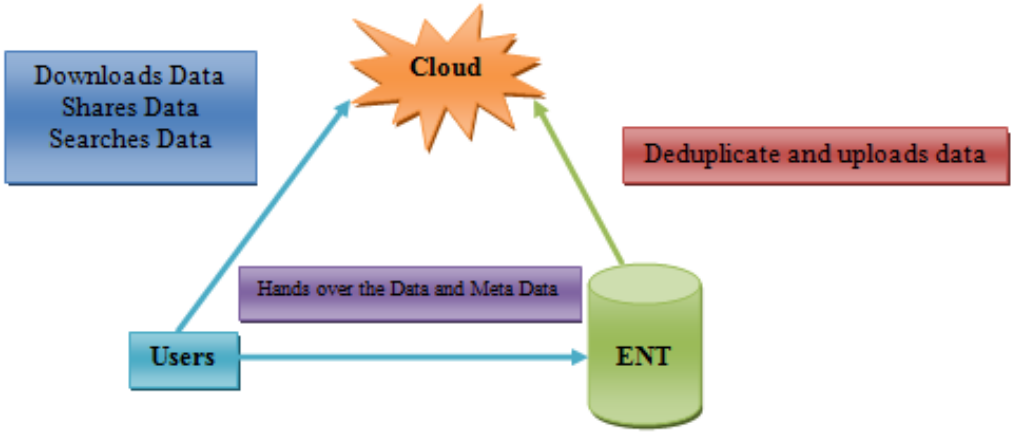

Figure 1: Operations between the User, Enterprise, and Cloud

Information de-duplication is a procedure of identifying the repetition in information and after that evacuating it. The subsequent exceptional single duplicate is stored and will at that point serve all the authorized clients. Information de-duplication includes a lot of pressure strategies that improves space use in a storage system by decreasing the measure of superfluous repetitive information. These systems can likewise be utilized to keep away from exchange of copied information between various hosts, therefore improving data transfer capacity use. De-duplication is commonly done by identifying copy pieces of information and keeping only one duplicate of these rehashed lumps. New events of lumps that were recently stored are supplanted by a reference to the as of now stored information piece. These references are regularly of irrelevant size when contrasted with the span of the repetitive information. The method can be connected inside a document or article (intra-de-duplication) or between various records (between de-duplication). Information de-duplication, a compelling information decrease method, stores just a solitary duplicate of every datum by contrasting their fingerprints and the current stored information to identify copied information. As of late, information de-duplication is widely received in the reinforcement and chronicle systems, which can accomplish extremely high de-duplication proportion. For example, agent de-duplication reinforcement systems including Data Domain DDFS, IBM Diligent, EMC Avarma, and Veritas PureDisk can more often than not achieve the de-duplication proportion of 20:1 in light of the fact that excess information in these systems is up to 90%. In spite of the fact that information de-duplication connected in cloud storage systems can diminish the measure of information and spare the network transmission capacity, the dynamicity of information in cloud storage systems are not the same as reinforcement and file systems, which brings difficulties for the investigation of information de-duplication in cloud storage systems. Here, the dynamic qualities of information are brought about by unique sharing between multiple clients. For instance, similar information gotten to by various clients and the entrance recurrence of various information in the meantime is extraordinary, the entrance recurrence of similar information changes additional time, and copied information shows up again in various S nodes for information alteration by clients.

2. Literature Survey

Nithin Das K.C, Melvin S George and Jaya P introducing a novel algorithm by incorporating Weighted Round Robin algorithm in Honeybee Inspired algorithm. Honeybee algorithm removes the tasks from virtual machines, which exceeds its capacity and assigns it to virtual machines with less load. It selects available virtual machines based on the tasks currently running on each virtual machine for tasks with priority. Weighted Round Robin algorithm allocates the weight to each virtual machines based on their computing capacity and allocates tasks accordingly. In their proposed work, they use Honeybee Inspired algorithm for tasks with priority by allocating the virtual machines to tasks based on their resource requirement. For the tasks with no priority assigned, they will use Weighted Round Robin algorithm as it can also accommodate pre-emptive tasks. For the tasks with priority, we will use Honeybee Inspired algorithm by assigning weights to each virtual machine and the virtual machine is selected according to the resource requirement of the tasks. Tasks with no priority are executed using Weighted Round Robin algorithm. Experimental results show that our algorithm shows better response time and data center processing time.

Farzana Sadia , Nusrat Jahan , Lamisha Rawshan , Madina Tul Jeba and Dr. Touhid Bhuiya proposed an improved resource scheduling algorithm based on priority and load balancing in cloud environment. That proposed algorithm performs load distribution of workloads among different VM based on priority. This algorithm is proposed in the aim of load balancing of different nodes by considering maximum throughput with minimum execution time. To achieve that, the VM are sorted according to their processing powers and job requests are assigned to VM based on their instruction numbers and priorities. The proposed algorithm is experimented using CloudSim simulator and the results demonstrated that the performance of the algorithm is better than other conventional algorithms. The proposed solution solved the problem of recourse allocation successfully. The present algorithm do not consider about troubleshooting of any virtual machine that will interrupt the load balancing. They will integrate recourse reallocation technologies which will reduce troubleshoot.

Prof. Rahul Bhole, Hoda Jagmeet Singh, Pushkaraj Khamkar, Pranav Joshi, Roshni Bendbhar focuses on load balancing in cloud computing. Load balancing in cloud computing was being ignored, but the rapidly growth in number of cloud users has raised demand for load balancing. This work has proposed an autonomous agent based load balancing mechanism which provides huge dynamic load balancing for cloud computing. Load neither balancing means distribution of resources among the users or request uniformly so that neither node is overloaded nor sitting idle. IF the load balancing is not proper then the efficiency of some overloaded nodes can degrade their performance and hence lead to SLA violation. Basically the load balancing algorithms are of three types which are as static, dynamic or mixed scheduling algorithms based on their nature where. Major contribution of this is load calculation of VM in a DC and when load of VM reaches near the threshold value, then load agent search for a candidate VM

from other DCs. Keeping the information of candidate VM, reduces the service time. Result obtained from this algorithm is work satisfactorily.

Vidhi Tailong, Vivek Dimri modified service broker policy(optimize response time) of cloud analyst in that they incorporate sorting and mapping so that policy have all the data center list according to the response time in ascending order so that it can further map the user bases according to the list of data centers. They used round robin algorithm for load distribution among data centers, modified response time service broker policy shows better results. In round robin algorithm using modified optimize response time service broker policy . They are addressing a main issue of cloud computing that is load balancing, this paper is describing about the load balancing issue in cloud computing, what is the impact of load unbalancing in the network, need of load balancing, also providing an approach to for enhancing the load distribution process . Basically load balancing is the process of shifting work load among various processors so that whole system become reliable and collision free and work can be distribute fair in between all the server . It not only increases the efficiency of virtual machines, also improves the performance of the system.

Kadda Beghdad Bey , Farid Benhammadi , Mohamed El Yazid Boudare and Salim Khamadja proposed a new task scheduling heuristic based on makespan improvement in cloud computing environment. The proposed approach generalizes the process of tasks exchange between both machines with the maximum and minimum makespan over all machines until the makespan value does not change. Distributed systems, a priori intended for applications by connecting distributed entities, have evolved into supercomputing to run a single application. Currently, Cloud Computing has arisen as a new trend in the world of IT (Information Technology). Cloud computing is an architecture in full development and has become a new computing model for running scientific applications. In this context, resource allocation is one of the most challenging problems. Indeed, assigning optimally the available resources to the needed cloud applications is known to be an NP complete problem. They propose a new task scheduling strategy for resource allocation that minimizes the completion time (makespan) in cloud computing environment.

Byoungwook Kim, Hwirim Byun, Yoon-A Heo and Young-Sik Jeong proposed an AMRO approach, which is an offload method that can respond to changes in the resource of mobile devices. For AMRO, an adaptive mobile resource offloading scheme was constructed to efficiently use the resources of mobile devices in the mobile cloud environment. The AMRM was designed and implemented to verify whether the proposed method had actually improved the processing speed compared to the existing offloading method. The AMRO increased the job processing speed in the mobile cloud environment through job allocation by considering the idle resources of mobile devices. Furthermore, the wastage of the idle resources of the mobile devices could be minimized by adaptive offloading through the identification of insufficient resources and idle resources. Thus, the AMRO offloading method was found to minimize the

waste of resources in the mobile cloud environment when it consisted of mobile devices only with no cloud server.

3. Proposed Work

3.1 Proposed POR and POW Schemes

We are proposing a scheme for private data de-duplication convention in the cloud stockpiling setting. We might want to feature the critical specialized contrast among open and private data de-duplication conventions. In private data de-duplication conventions, we consider the data to be encoded by the client first before the transfer, with keys not being imparted to the cloud provider, though openly data de-duplication conventions the data is either uploaded either in plain content form or scrambled with shared keys among clients and the cloud stockpiling provider. In the former, for example private data de-duplication conventions, the effect of encryption on clients' data in various can make cross-enterprise de-duplication endeavors challenging.

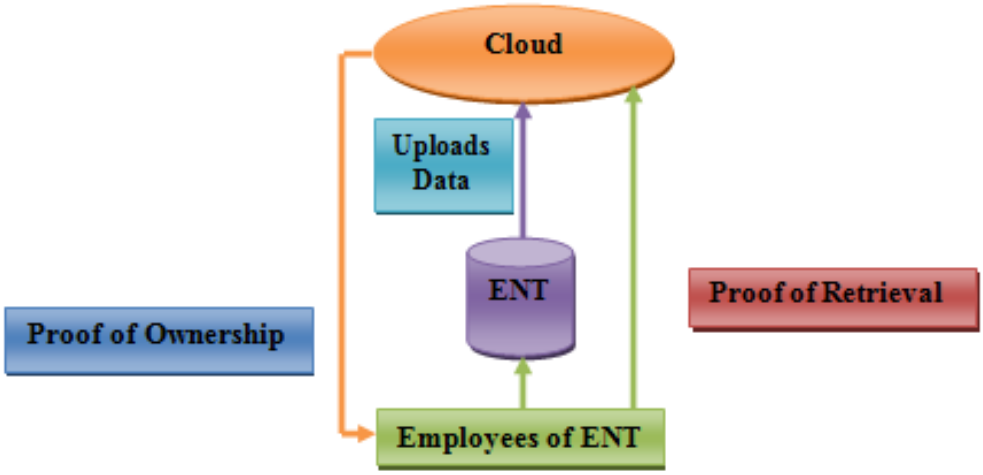

Figure 2: Flow of POR and POW Protocols among the Cloud, ENT and Users

The workers are the clients of the cloud stockpiling administrations and are approved to run the POR convention with the cloud for assuring the integrity of the data in the cloud. These clients will likewise be scrutinized by the cloud for the ownership of their data through the POW convention. Figure 2 depicts the operational stream for POR and POW conventions involving all the three players. There are a few essential ways to deal with check the integrity of put away data in the cloud. A guileless methodology is for the client to download the file and check its integrity. In most application, this speaks to pricey methodology regarding bandwidth use and thus it doesn't speak to a practical alternative. Another basic methodology requires a client to register a keyed hash hk(F) for a given key k and a file F. The client would then transfer the source file F to the cloud, while retaining the hash esteem hk(F). For the POR, the client would send the key used to the cloud stockpiling provider and request that it figure and resend the hash of the file. By keeping many hash esteems and their corresponding keys, the client can run this POR convention various number of times. There are a few downsides to this methodology including the requirement for the cloud stockpiling provider to figure the hash

estimation of the whole file and the linear connection between's the quantity of the keys and the hash esteems kept to the quantity of POR inquiries which can be make. In the following area, we will exhibit an efficient and secure scheme for a POR convention in which a client can confirm the integrity of his data against the cloud stockpiling provider who is practicing data de-duplication at the enterprise level. We first rundown a lot of performance prerequisites for a POR convention over a private data de-duplication situations: 1) the convention should utilize the basic open, secure capacities to guarantee customer side, cross-client data de-duplication in order to identify figure writings corresponding to the equivalent underlying plain content. 2) the convention bandwidth use ought to be essentially lower than what is needed to download run of the mill file asked. 3) The convention ought to incur minimum computational overhead on the cloud and the cloud. Ideally, the convention expel or limit the need of operating on the whole file, as fundamental. 4) The convention ought to likewise either not require additional capacity or cutoff additional capacity needed to perform POR for clients and the enterprise. In the following area, we will examine the performance of our proposed Private Data De-duplication convention for Proof of Retrieval - consequently forth alluded to as PDD-POR regarding the four criteria recorded. Our convention needs to address various issues: First, the CSP isn't believed, every one of the data and its corresponding indices should be scrambled. Given that the convention needs to likewise empower cross-enterprise level data de-duplication in the cloud, we have to introduce a key administration scheme which is independent of the cloud stockpiling provider. We propose to utilize merged encryption for the reason for independent encryption keys over the enterprises. The client will just must have the index encryption key regardless of the file measure. Additionally, at expense of some metadata per file, the client can confirm the integrity of the file with the assistance of an accumulated MAC. Such a methodology will evacuate the requirement for the cloud stockpiling provider of traversing the whole file for every cycle of the POR. To put it plainly, PDDPOR convention divides the files to littler squares of settled sizes, for example 'lumps'. A focalized encryption is then connected to each piece and the outcome in indexed using a scheme, for example, the B* tree index. Then, each piece is encoded with eradication codes, for example, Turbo encoding scheme to ensure against debasement of little portions of the file. In the following stage, the lumps are grouped into sections and then an amassed MAC is determined for each fragment. The encoded squares and the scrambled index is then placed in the cloud and the collected MACs are kept with enterprise. In the following, we will explain in detail each progression, and talk about the rationale for their choice just as their performance.

4. Experimental Results

Efficiency

Existing 1	Existing 2	Proposed
22	7	35
27	15	39
35	20	44
44	22	56
51	26	60

Table 1: Comparison table of Efficiency

The comparison table of Efficiency describes the different values of existing and proposed method. While comparing the existing and proposed method the proposed method shows the better results. In each level of comparison the proposed method gives the better results. Existing 1 value starts from 22 to 51 existing 2 values starts from 7 to 26 and proposed method values starts from 35 to 60.

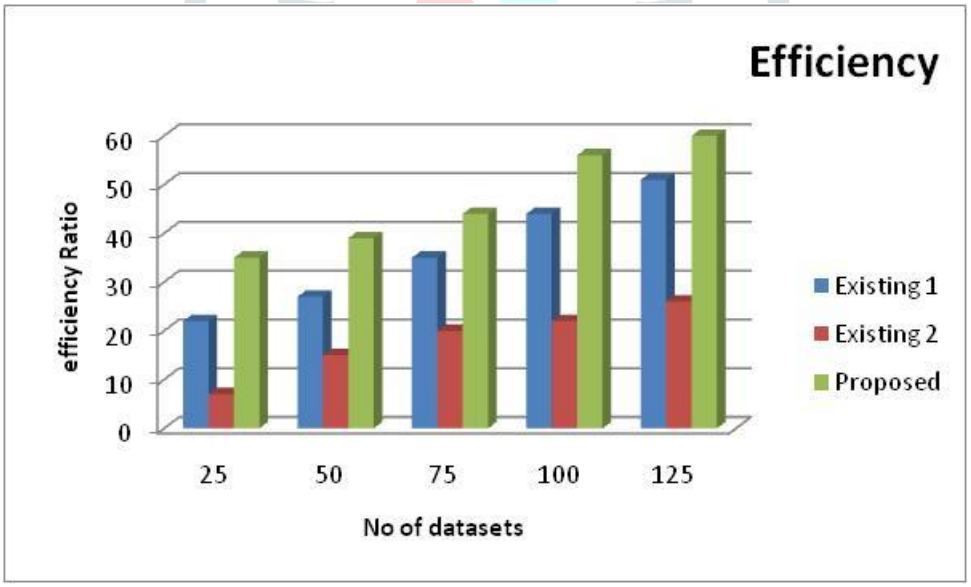

Figure 3: Comparison chart of Efficiency

The comparison chart of Efficiency shows the different values of existing and proposed method. No of datasets in X axis and efficiency ratio in Y axis. Compare to existing and proposed method the proposed method shows the better results. Existing 1 values are 22-51 existing 2 values are 7-26 proposed method values are 35-60.

Redundancy

Existing 1	Existing 2	Proposed
0.09	0.04	0.02
0.14	0.08	0.05
0.19	0.13	0.09
0.25	0.19	0.14
0.3	0.22	0.19

Table 2: Comparison table of Redundancy

The comparison table of Redundancy describes the different values of existing and proposed method. While comparing the existing and proposed method the proposed method shows the better results. In each level of comparison the proposed method gives the better results. Existing 1 value starts from 0.09 to 0.3 existing 2 values starts from 0.04 to 0.2 and proposed method values starts from 0.02 to 0.19.

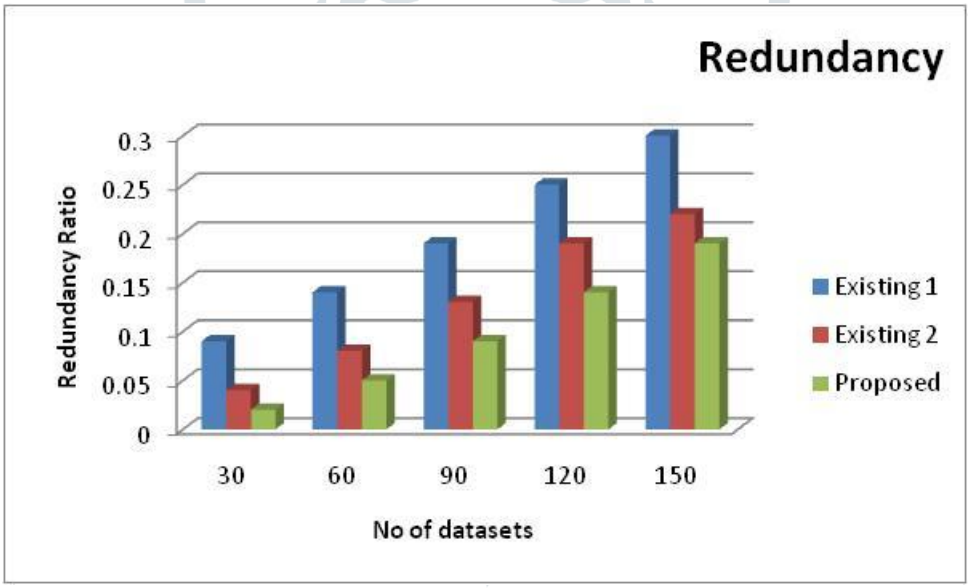

Figure 4: Comparison chart of Redundancy

The comparison chart of Redundancy shows the different values of existing and proposed method. No of datasets in X axis and redundancy ratio in Y axis. Compare to existing and proposed method the proposed method shows the better results. Existing 1 values are 0.09-0.3 existing 2 values are 0.04-0.2 proposed method values are 0.02-0.19.

Recall

Existing 1	Existing 2	Proposed
0.09	1.3	2.2
0.14	1.8	2.7
0.19	2.1	3.5
0.25	2.4	4.4
0.3	3	5.1

Table 3: Comparison table of Recall

The comparison table of Recall describes the different values of existing and proposed method. While comparing the existing and proposed method the proposed method shows the better results. In each level of comparison the proposed method gives the better results. Existing 1 value starts from 0.09 to 0.3 existing 2 values starts from 1.3 to 3 and proposed method values starts from 2.2 to 5.1.

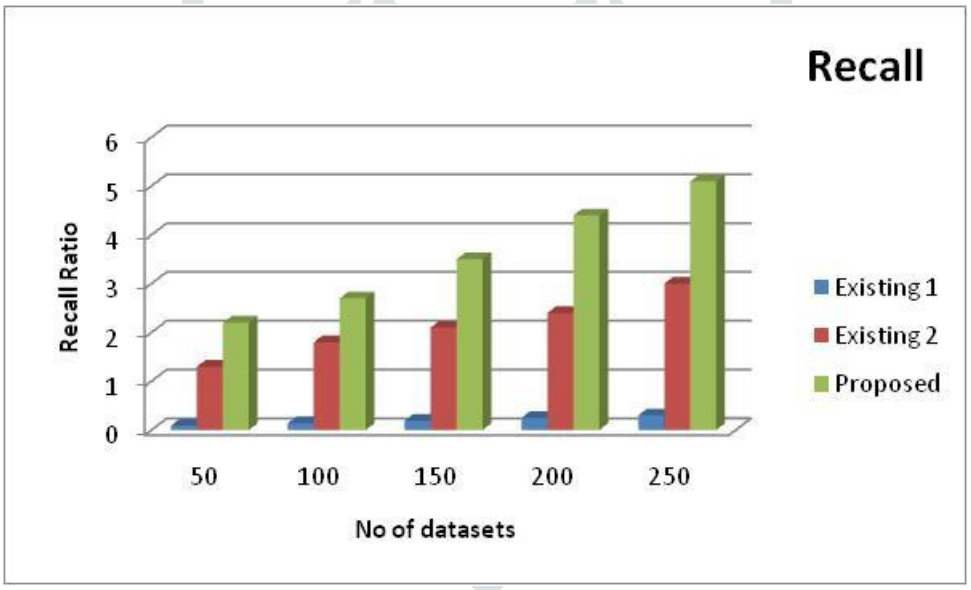

Figure 5: Comparison chart of Recall

The comparison chart of Recall shows the different values of existing and proposed method. No of datasets in X axis and recall ratio in Y axis. Compare to existing and proposed method the proposed method shows the better results. Existing 1 values are 0.09-0.3 existing 2 values are 1.3-3 proposed method values are 2.2-5.1.

Accuracy Ratio

Existing 1	Existing 2	Proposed
76	52	90.1
77.4	57	90.9
79.1	66	93.2
79.5	70	94.5
82	74	98

Table 4: Comparison table of Accuracy Ratio

The comparison table of Accuracy Ratio describes the different values of existing and proposed method. While comparing the existing and proposed method the proposed method shows the better results. In each level of comparison the proposed method gives the better results. Existing 1 value starts from 76 to 82 existing 2 values starts from 52 to 74 and proposed method values starts from 90.1 to 98.

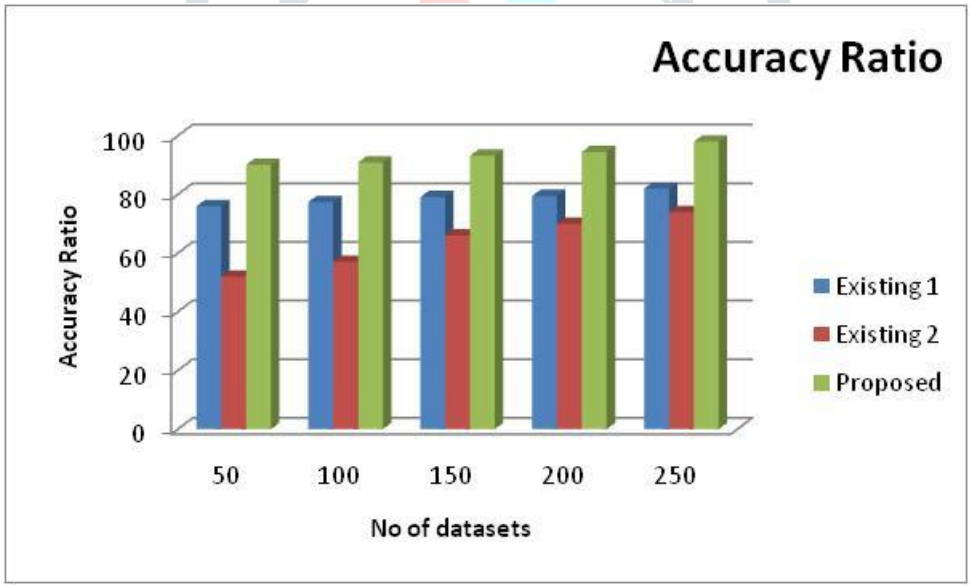

Figure 6: Comparison chart of Accuracy Ratio

The comparison chart of Accuracy Ratio shows the different values of existing and proposed method. No of datasets in X axis and accuracy ratio in Y axis. Compare to existing and proposed method the proposed method shows the better results. Existing 1 values are 76-82 existing 2 values are 52-74 proposed method values are 90.1-98.

Conclusion

Proposed a two-level data de-duplication structure that can be utilized in the cloud stockpiling by enterprises who share a single regular CSP for their administrations. By employing the cross-client data de-

duplication performed at the enterprise level and the cross enterprise data de-duplication performed at the CSP level, it is normal that enterprises can re-appropriate their data to the cloud while the CSP can accomplish cost and space savings. The system is designed dependent on the constraint that the CSP is semi-genuine, thereby can't be believed when handling clients' data. Our scheme is designed to guarantee protection of the data under such constraint. We then propose POR and POW conventions for private data de-duplication in which the CSP is considered to be semi-legitimate. These schemes are secure and lightweight as far as the computational and capacity overheads forced on the enterprise since they are based over our de-duplication structure and both supplement each other to take care of business a total a model.

References

[1] **Chi Yang and Jinjun Chen,** "A Scalable Data Chunk Similarity based Compression Approach for Efficient Big Sensing Data Processing on Cloud", **Published in:** IEEE Transactions on Knowledge and Data Engineering (Volume: 29, Issue: 6, June 1 2017), **Publisher:** IEEE, **Date of Publication:** 18 February 2016, Print ISSN: 1041-4347; Electronic ISSN: 1558-2191; CD-ROM ISSN: 2326-3865

[2] **Youjip Won, Kyeongyeol Lim, and Jaehong Min,** "MUCH: Multithreaded Content-Based File Chunking", **Published in:** IEEE Transactions on Computers (Volume: 64, Issue: 5, May 1 2015), **Publisher:** IEEE; **Date of Publication:** 14 May 2014; **Date of Publication:** 14 May 2014

[3] **Xu Zhang and Yue Cao,** "A Cooperation-Driven ICN-based Caching Scheme for Mobile Content Chunk Delivery at RAN", **Published in:** 2017 13th International Wireless Communications and Mobile Computing Conference (IWCMC); **Publisher:** IEEE; **Electronic ISSN:** 2376-6506

[4] **Chuanshuai Yu, Chengwei Zhang, Yiping Mao, Fulu Li,** "Leap-based Content Defined Chunking --- Theory and Implementation", **Published in:** 2015 31st Symposium on Mass Storage Systems and Technologies (MSST); **Publisher:** IEEE; Print ISSN: 2160-195X; Electronic ISSN: 2160-1968

[5] **Daniel Posch, Hermann Hellwagner and Peter Schartner**, "On-Demand Video Streaming based on Dynamic Adaptive Encrypted Content Chunks", **Published in:** 2013 21st IEEE International Conference on Network Protocols (ICNP); **Publisher:** IEEE; Electronic ISBN: 978-1-4799-1270-4; Print ISSN: 1092-1648

[6] **Chi Yang and Jinjun Chen,** "A Scalable Data Chunk Similarity based Compression Approach for Efficient Big Sensing Data Processing on Cloud", **Published in:** IEEE Transactions on Knowledge and Data Engineering (Volume: 29, Issue: 6, June 1 2017); **Publisher:** IEEE; Print ISSN: 1041-4347; Electronic ISSN: 1558-2191; CD-ROM ISSN: 2326-3865

[7] **C. Goktug Gurler, S. Sedef Savas, and A. Murat Tekalp,** "VARIABLE CHUNK SIZE AND ADAPTIVE SCHEDULING WINDOW FOR P2P STREAMING OF SCALABLE VIDEO", **Published in:** 2012 19th IEEE International Conference on Image Processing; **Publisher:** IEEE; Print ISSN: 1522-4880; Online ISSN: 1522-4880; Electronic ISSN: 2381-8549

[8] **Haiying Shen and Jin Li** , "A DHT-Aided Chunk-Driven Overlay for Scalable and Efficient Peer-to-Peer Live Streaming", **Published in:** IEEE Transactions on Parallel and Distributed Systems (Volume: 24, Issue: 11, Nov. 2013); **Publisher:** IEEE; **Date of Publication:** 22 October 2012; Print ISSN: 1045-9219; Electronic ISSN: 1558-2183; CD-ROM ISSN: 2161-9883

[9] **Deepavali Bhagwat, Kave Eshghi, Darrell D. E. Long and Mark Lillibridge,** "Extreme Binning: Scalable, Parallel Deduplication for Chunk-based File Backup", **Published in:** 2009 IEEE International Symposium on Modeling, Analysis & Simulation of Computer and Telecommunication Systems; **Publisher:** IEEE; Print ISBN: 978-1-4244-4927-9; CD-ROM ISBN: 978-1-4244-4928-6

[10] **Chu-Hsing Lin, Chen-Yu Lee, Yi-Shiung Yeh, Hung-Sheng Chien and Shih-Pei Chien**, "Generalized Secure Hash Algorithm: SHA-X", **Published in:** 2011 IEEE EUROCON - International Conference on Computer as a Tool; **Publisher:** IEEE; Electronic ISBN: 978-1-4244-7487-5; Print ISBN: 978-1-4244-7486-8;CD-ROM ISBN: 978-1-4244-7485-1

[11] **Sang-Hyun Lee, Kyung-Wook Shin**, "An Efficient Implementation of SHA processor Including Three Hash Algorithms (SHA-512, SHA-512/224, SHA-512/256)", **Published in:** 2018 International Conference on Electronics, Information, and Communication (ICEIC); **Publisher:** IEEE; **Print on Demand(PoD) ISBN:** 978-1-5386-4754-7

[12] **IMTIAZ AHMAD AND A. SHOBA DAS**, "Analysis and Detection Of Errors In Implementation Of SHA-512 Algorithms On FPGAs", **Published in:** The Computer Journal (Volume: 50, Issue: 6, Nov. 2007); **Publisher:** IEEE; **Date of Publication:** Nov. 2007; Print ISSN: 0010-4620; Electronic ISSN: 1460-2067

[13] **Alavi Kunhu, Hussain Al-Ahmad and Fatma Taher**, "Medical Images Protection and Authentication using hybrid DWT-DCT and SHA256-MD5 Hash Functions", **Published in:** 2017 24th IEEE International Conference on Electronics, Circuits and Systems (ICECS); **Publisher:** IEEE; Electronic ISBN: 978-1-5386-1911-7; Print on Demand(PoD) ISBN: 978-1-5386-1912-4

[14] **Mochamad Vicky Ghani Aziz, Rifki Wijaya, Ary Setijadi Prihatmanto, Diotra Henriyan**, "HASH MD5 Function Implementation at 8-bit Microcontroller", **Published in:** 2013 Joint International Conference on Rural Information & Communication Technology and Electric-Vehicle Technology (rICT & ICeV-T); **Publisher:** IEEE; Electronic ISBN: 978-1-4799-3365-5; Print ISBN: 978-1-4799-3363-1;CD-ROM ISBN: 978-1-4799-336

[15] **Eko Sediyono, Kartika Imam Santoso and Suhartono**, "Secure Login by Using One-time Password Authentication Based on MD5 Hash Encrypted SMS", **Published in:** 2013 International Conference on Advances in Computing, Communications and Informatics (ICACCI), **Publisher:** IEEE; Electronic ISBN: 978-1-4673-6217-7; Print ISBN: 978-1-4799-2432-5; CD-ROM ISBN: 978-1-4799-2659.

[16] **Nithin Das K.C, Melvin S George and Jaya P**, "Incorporating Weighted Round Robin in Honeybee Algorithm for Enhanced Load Balancing in Cloud Environment", **Published in:** 2017 International Conference on Communication and Signal Processing (ICCSP); **Publisher:** IEEE; Electronic ISBN: 978-1-5090-3800-8; Print on Demand(PoD) ISBN: 978-1-5090-3801-5

[17] **Farzana Sadia , Nusrat Jahan , Lamisha Rawshan , Madina Tul Jeba and Dr. Touhid Bhuiya**, "A Priority Based Dynamic Resource Mapping Algorithm For Load Balancing In Cloud", **Published in:** 2017 4th International Conference on Advances in Electrical Engineering (ICAEE); **Publisher:** IEEE; Electronic ISBN: 978-1-5386-0869-2; USB ISBN: 978-1-5386-0868-5; Print on Demand(PoD) ISBN: 978-1-5386-0870-8; Electronic ISSN: 2378-2692

[18] **Prof. Rahul Bhole, Hoda Jagmeet Singh, Pushkaraj Khamkar, Pranav Joshi, Roshni Bendbhar**, "Load Balancing in Cloud Computing Using Autonomous Agents", Imperial Journal of Interdisciplinary Research (IJIR) Vol-3, Issue-3, 2017 ISSN: 2454-1362, http://www.onlinejournal.in

[19] Vidhi Tailong, Vivek Dimri, "Load Balancing in Cloud Computing Using Modified Optimize Response Time", Volume 6, Issue 5, May 2016; ISSN: 2277 128X; International Journal of Advanced Research in Computer Science and Software Engineering

[20] **Kadda Beghdad Bey , Farid Benhammadi , Mohamed El Yazid Boudare and Salim Khamadja**, "Load Balancing Heuristic for Tasks Scheduling in Cloud Environment", DOI: 10.5220/0006240304890495 In Proceedings of the 19th International Conference on Enterprise Information Systems (ICEIS 2017) - Volume 1, ISBN: 978-989-758-247-9

[21] **Byoungwook Kim, Hwirim Byun, Yoon-A Heo and Young-Sik Jeong,** "Adaptive Job Load Balancing Scheme on Mobile Cloud Computing with Collaborative Architecture", Symmetry 2017, 9, 65; DOI:10.3390/sym9050065; www.mdpi.com/journal/symmetry