Efficient Data Administration

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ABSTRACT

Cloud Computing is a novel computing paradigm which is recognized as an arbitrary to traditional reference technology right to its intrinsic resource-sharing and low-maintenance characteristics. One of the virtually fundamental services offered by CSPs (Cloud Service Providers) is cloud storage. To increasing reliability and efficiency of data storage in the cloud the technique used is replication but its drawback is data loss and higher space consumption. One way to increase the data reliability and reducing the storage space in the cloud is Erasure Coding. In Erasure Coding, the data is fragmented and further encoded mutually into data pieces and stored in different locations. The arbitrary benefit of the Erasure Coding is that the corrupted data can be absolutely reconstructed into separate information. Erasure code comprises of two coding techniques regenerating code and locally repairable code. Regenerating Code is used for balancing storage space and its bandwidth. The Locally repairable code is the technique used to overcome the Disk I/O overhead in the Cloud Storage. But applying erasure code in cloud storage increases access time. So this paper explored the storage space efficiency of erasure codes and the repair traffic efficiency of replication. As a new area of research in replication and erasure coding technique can be combined using for data storage in the cloud for enhancing its overall efficiency.

Keywords

Erasure coding, Cloud storage, Regenerating codes, Locally repairable codes.

1. INTRODUCTION

With the decreasing of information measure and computerized data valuation, an objective has been determined that foremost IT corporations, a well known as Google, Microsoft, and Amazon, establish their services inside data centers and extend services globally over a high-bandwidth network. This new paradigm of providing computing services is termed cloud computing. Which is well-known as an absolute to ancient information technology due to its intrinsic resource-sharing and low-maintenance characters [1]. One of the virtually fundamental services offered by CSPs (Cloud Service Providers) is cloud storage. By migrating the native information management directed toward the cloud, users will enjoy high-quality services and gather significant investment in their local infrastructure. Since the clouds are sometimes operated by industrial CSPs that are very likely to be outside of the trusted domain of the users, it’s quite impudent for the cloud to produce information responsibly and confidentiality. To attain the responsibility, several proposals are planned to introduce information redundancy to avoid information unretrievable within the case of some information shares are missed accidentally.

2. CLOUD STORAGE

In the framework of cloud computing, computerized information has not only been a consistent component of largescale cloud services, but furthermore been provided as a virtual storage infrastructure in a pay-as-you-go approach, a well known as Amazon S3(Simple storage service). Moreover, the volume of data stored inside data centers has been observed instant growing eventually faster than Moore’s Law[2]. It has been released that the space for storing used for icon storage only in Facebook has been around 20PB in 2011 and is increasing by 60 TB every week[3]. To approach the necessities of the substantial volume of storage, the cloud storage system needs to grow out, i.e., storing information in a very large number of artifact disks. during this plan, it becomes a significant challenge for cloud storage systems to set up data integrity, the right to both an outsized variety of disks and their artifact nature. Even though the number of disk failures is a small portion of the data centers, there can still be a large number of such failures everyday due to a large number of disks. For example[4], in a Facebook cluster with 3000 nodes, there are originally at uttermost 20 repairs triggered everyday. Apart from storage devices, the contrasting systems in the data center, one as the networking or thing systems, am within one area cause outages in the data center[4], making data having a full plate or even gain lost.

To increase reliability and efficiency of data storage in the cloud two techniques are used:

1. Replication
2. Erasure Code

Cloud file systems transform the requirements for erasure codes because they have properties and workloads that differ from traditional file systems and storage arrays. Our model for a cloud file system using erasure codes is inspired by Microsoft Azure [5]. It conforms well with HDFS [6] modified for RAID-6 [7] and Google’s analysis of redundancy coding [8]. Some cloud file systems, such as Microsoft Azure and also the Google File system, produce an append-only write workload employing a massive block size. Writes are accumulated and buffered till a block is full and so the block is sealed: it’s erasure coded and also the coded blocks are distributed to storage nodes. Consequent reads to sealed blocks usually access smaller amounts information than the block size, depending upon workload [9]. To reduce storage overhead, cloud file systems are transforming from replication to erasure codes. This method has disclosed new dimensions on which to judge the performance of various coding schemes: the amount of information utilized in recovery and when performing degraded reads

2.1 Replication

Although wide-scale replication has the potential to extend availableness and durability, it introduces two vital challenges
Triplication has been favored because of its ease of implementation, good read and recovery performance, and reliability. The storage overhead of replication is a concern, leading system designers to consider a secure coding as an alternative. The performance tradeoffs between replication and erasure coding are well understood and have been evaluated in many environments, such as peer-to-peer file systems [15] and open-source coding libraries [12].

1.1 Techniques to achieve efficient data management

<table>
<thead>
<tr>
<th>Researcher</th>
<th>Strategy</th>
<th>Description</th>
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<tbody>
<tr>
<td>Wolfson et al. (1997)</td>
<td></td>
<td>The algorithm that changes the replication scheme as changes occur in the read–write pattern. The algorithm continuously moves the replication scheme toward an optimal scheme.</td>
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<tr>
<td>Moore (2002)</td>
<td>Swiftly increasing as storage requirements are rising by 60% annually</td>
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<tr>
<td>Lamehamedi et al. (2002)</td>
<td>Presented a set of replica management services and protocols to offer high data availability, low bandwidth consumption, improved fault tolerance, and scalability of the system by considering the access cost and replication gains.</td>
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<tr>
<td>Ranganathan et al. (2002)</td>
<td>Dynamic and Model-driven replication strategy</td>
<td>Automatically produces copies in a decentralized manner whenever it is required to improve the system availability. In this model, all the peers are independent to take replication decision and they can create copies of files they store.</td>
</tr>
<tr>
<td>Shafi et al. (2003)</td>
<td>Studied real web server workloads from sports, e-commerce, financial, and internet proxy cluster and found that the average server utilization varies between 11% and 50%. The reason for the low utilization is because the system has to offer over provision to guarantee performance at the periods of peak loads. This observation gives us opportunities to reduce the energy consumption of clusters.</td>
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<tr>
<td>Pinheiro et al. (2003)</td>
<td>Developed a system that dynamically turns cluster nodes on/off to handle the load imposed on the system. The system makes reconfiguration decisions by considering the total workload imposed on the system, the power, and performance implications of changing the current configuration.</td>
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3. BRIEF REVIEW

Cloud Computing is a novel computing paradigm which is recognized as an arbitrary to traditional reference technology right to its intrinsic resource-sharing and low-maintenance characteristics. One of the virtually fundamental services offered by CSPs (Cloud Service Providers) is cloud storage.

3.1 Techniques to achieve efficient data management

The default storage policy in cloud file systems has become triplication (triple replication), implemented in the Google File system [11] and adopted by Hadoop[6] and many others.
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<tr>
<th>Authors</th>
<th>Method/Algorithm</th>
<th>Description</th>
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<tbody>
<tr>
<td>Park et al. (2004)</td>
<td>Improve the network locality by replicating the files within the network region</td>
<td></td>
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<tr>
<td>Tang et al. (2005)</td>
<td>Two dynamic replication algorithms</td>
<td></td>
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<tr>
<td>Ge et al., (2007)</td>
<td>Miser a run-time DVFS scheduling system</td>
<td></td>
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<tr>
<td>Fan et al. (2007)</td>
<td>Investigated the power consumption of a typical server. They reported that a disk drive takes 12 W. From a power standpoint, it seems the power consumption of a single disk drive is not a problem.</td>
<td></td>
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<tr>
<td>Yuan et al. (2007)</td>
<td>Dynamic data replication strategy</td>
<td></td>
</tr>
<tr>
<td>Deng and Wang (2008)</td>
<td>Green computing has been a hot research topic in the community of cluster computing for many years. It is more challenging for the storage clusters because of the explosive growth of data</td>
<td></td>
</tr>
<tr>
<td>Verma et al. (2008)</td>
<td>Employed power management techniques such as dynamic consolidation and dynamic power range enabled by low power states on servers to reduce the power consumption of high-performance applications on modern power efficient servers with virtualization support.</td>
<td></td>
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<tr>
<td>Caulfield et al., (2009)</td>
<td>Utilize slow-power processors and flash memory to reduce the power consumption and improve performance for data-centric cluster</td>
<td></td>
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<tr>
<td>Huang and Feng (2009)</td>
<td>A run-time DVFS scheduling algorithm</td>
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Investigations into applying RAID-6 (two faults tolerant) erasure codes in cloud file systems show that they reduce storage overheads from 200% to 25% at a small cost in reliability and the performance of large reads [14]. Microsoft research further explored the cost/benefit trade-offs and expand the analysis to new metrics: power proportionality and complexity. For these reasons, Facebook is evaluating RAID-6 and erasure codes in their cloud infrastructure [7].

4. PROPOSED WORK
We present a new family of redundancy schemes called replicated erasure codes (REC), which combine the storage space efficiency of erasure codes and the repair-traffic efficiency of replication. REC encodes the data using traditional erasure codes and then each encoded chunk is stored in a replicated manner. If a replicated chunk is erased, it is repaired eagerly (as soon as discovered), by replicating one of the remaining replicas. This operation is cheap in terms of computation and network traffic. If all replicas of an encoded chunk are erased, they are repaired using the erasure code’s redundancy. As this repair is expensive and inefficient, it is done lazily, repairing several erased replicas at once. Combining a frequent efficient repair method with a rare inefficient repair method results in a low amortized repair traffic. In addition, REC does not increase the storage overhead significantly for the following observation. Replicating the encoded data also contributes to file availability and persistence and therefore less redundancy is required in the erasure code. We show that REC’s total storage space is not substantially increased compared to erasure codes alone. Further, when taking into account the repair traffic, we show that REC uses less storage space than erasure codes.

First, we analyze when a file f, which is stored using an REC scheme, complies with the availability and persistence requirements that are part of our problem model. Then, we show how to automatically calculate suitable REC parameters, which also relies on estimating the problem model’s quantities that are not explicitly given. These capabilities demonstrate how REC redundancy schemes can be used in practice as part of distributed storage systems, in order to solve the stated problem.
problem. Finally, calculate the expected network traffic that is generated as part of chunk repair operations, which allows comparing the costs of different REC schemes.

1. File availability and persistency
2. Minimum threshold calculation
3. Network Monitoring
4. Repair Traffic
   4.1. Heavy repair traffic
   4.2. Light repair traffic

5. CONCLUSION
We have described the availability and durability gains provided by an erasure-resilient system. We quantitatively compared systems based on replication to systems based on erasure codes. Our analysis showed that erasure resilient codes use an order of magnitude less bandwidth and storage than replication for systems with similar MTTF [14]. REC reduces the required repair traffic by about 30%. This is while maintaining similar and sometimes even better storage overheads than EC. The repair traffic of a redundancy scheme is affected by the scheme’s repair degree and its storage consumption. The amount of storage affects the number of chunk erasures in the system and the repair degree indicates the number of chunks sent in order to repair one erased chunk. Therefore, a repair efficient scheme must minimize both [13].

6. REFERENCES