DDS

Assignment 2

Erasure Coding

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Introduction

How can I recover my data after data is lost? Erasure coding is a technique to recover data after data is lost by saving an amount of redundant data. When the time came, we can recover the original data with the help of extra ones. Also, we need a balance between the amount of redundant data and the number of server failure tolerant.

In a simple scenario, to protect against M server failure, we can store our data on the M+1 server, as a result, the final server can recover our data. Such an approach has a great cost of storage, because, we need to store a lot of redundant data. The redundancy is the ratio between the amount of original data and the amount of saved data, which is equal to M+1 in this approach.

The optimal solution is encode the original data in N block of 1/K and store them through M different sever. The K can calculate as following:

$$K=N-M$$

We are able to recover the original data by decode any K of block which, their total volume is equal to the original data.

Assignment 1

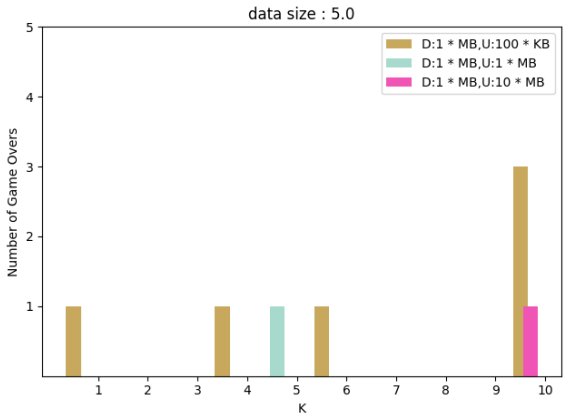
The assignment try to simulate the erasure coding with different input parameter . In first assignment we store one block per each server.

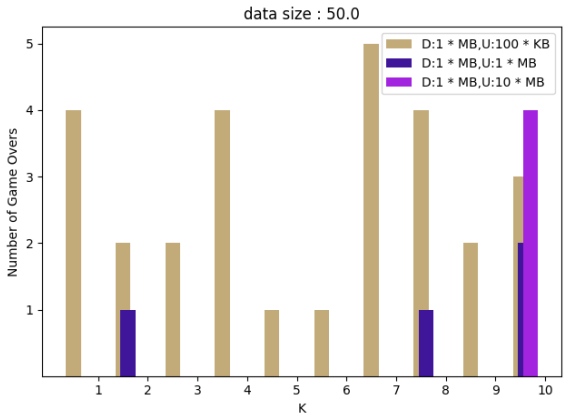
Experiment 1

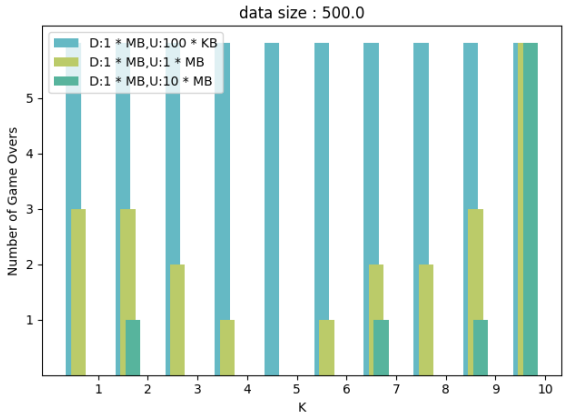
In the first experiment , we analysis the failure rate of the system with different value of K for different data size. We examined different combination of download/upload speed alongside different values of K to observe the affect of input param on the failure rate of system through 5 times iteration with maximum life Time of ten years.

Data	5GB,100GB,500GB
Upload Speed	100KB,1MB,10MB
Download Speed	1MB
K	[1,10]
Iteration	[5]

Result







From above chart three things can clearly conclude:

1. Increase the number of failure by increasing the data size
2. k=N (10 in this case) is the worst chose
3. In this scenario the optimal k value is about 5 , if we have enough connection speed

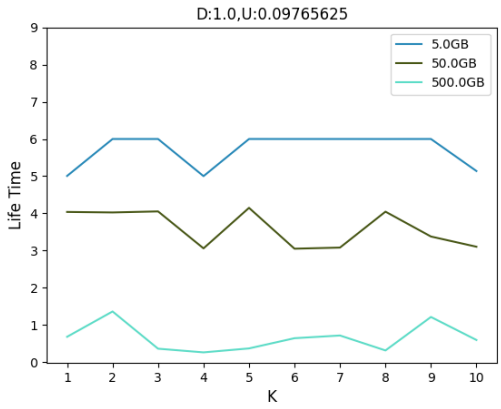
The worst scenario is for k=N. We can see the same phenomena in all of the tests. The reason is, there is no redundancy for K=N. No redundancy

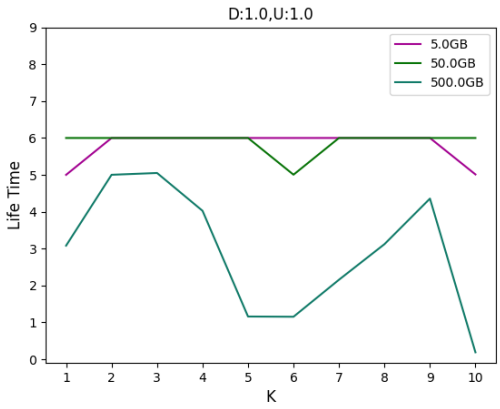
means each block ok data store in just one node, as a result, failure of a node causes the entire data to be lost.

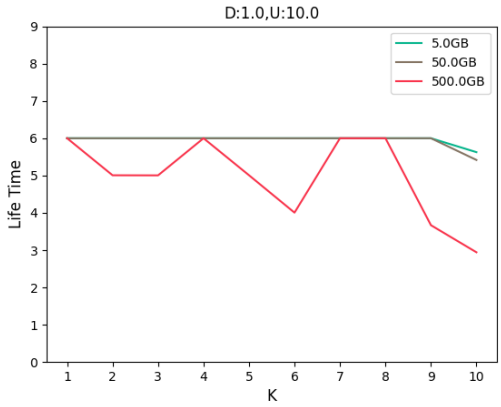
In 5GB we can see almost no failure (Expect for k=10) in any of connection speed. By increasing the amount of data we can observe the failure raise significantly. Of course, the reason is, nodes do not have enough time to upload or download blocks of data, we can conclude with increasing the data size, increasing the connection speed is mandatory.

Experiment 2

In the second assignment we simulate the system life time with same input param as before.







The lifetime test also approves the results from previous experiments. We can observe the effect of increasing the data size on the system's time even with a higher connection speed. We can even in highest download/upload

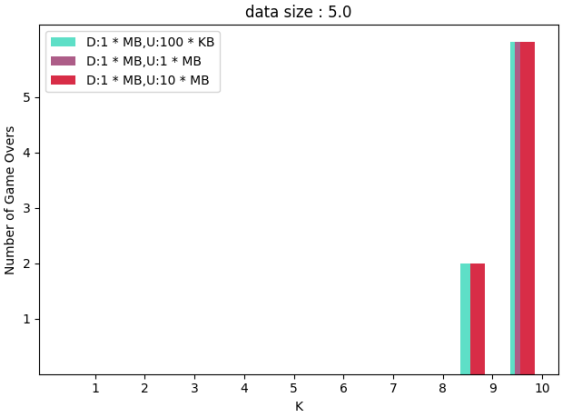
speed the system with 500GB has the shortest lifetime. Also, we can observe increasing the system lifetime, by increasing the connection speed. In the case of K, we can see k=10 has the shortest lifetime again.

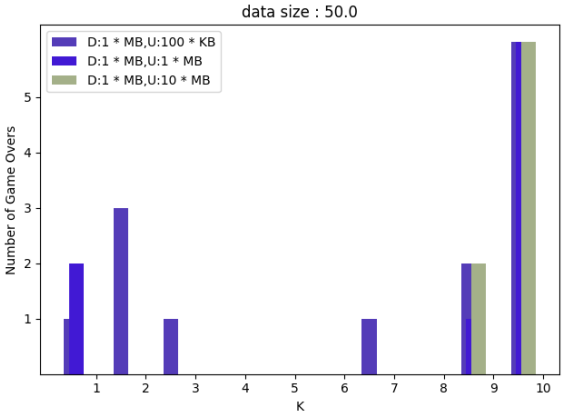
Assignment 2

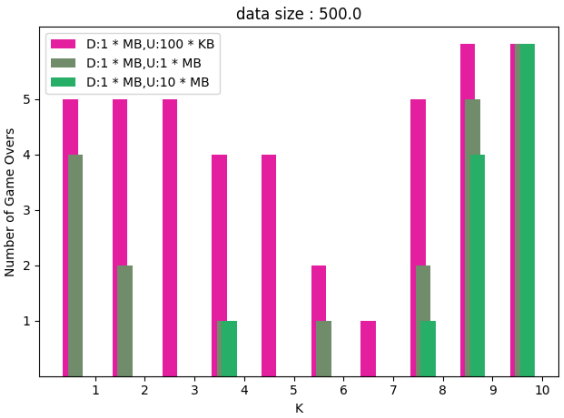
The assignment try to simulate the erasure coding with multi block per server . In second assignment we store 10 blocks per each server.

Experiment 1

In the first experiment , we analysis the failure rate of the system with different value of K for different data size. We examined different combination of download/upload speed alongside different values of K to observe the affect of input param on the failure rate of system through 5 times iteration with maximum. The system input parameter is like Assignment 1 again.





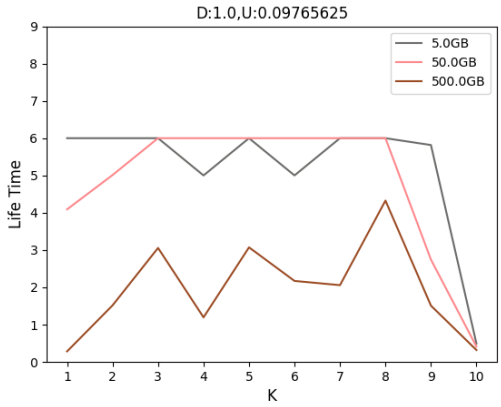


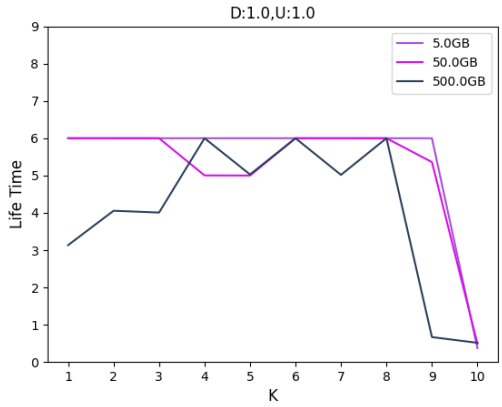
In such scenario , each server is capable to store more than one

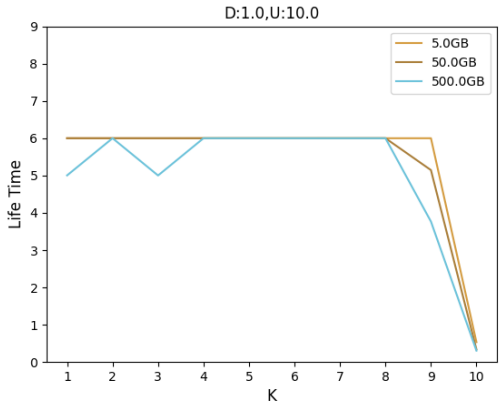
block , as a result , we can expect reduce the average failure. However, the same phenomena about the value of K, data size and connection speed can observe again. The above chart shows even with lower download/upload rate, the failure rate reduce significantly.

Experiment 2

In the second assignment we simulate the system life time with same input param as before. Again we have 10 block per server.







Again as we expect , the overall life time increase too.

Conclusion

From the above experiment, we conclude the best value for k is almost somewhere around N/2. The higher value for K reduces the number of redundant blocks e.g in k=N we always have the worst case. As we discuss in such a scenario there is no redundant block, as a result, the failure of even one server leads to data loss. The second important parameter is the connection speed. If we exclude the K=N, we can see the higher connection speed observe so much better result. In the case of multi-block per server, the test approves we can achieve a much better result with the same connection speed and data size.