A Performance Study on Disk Access Considering Reading Size

Atsuki KAMO[†], ***Non member***, ***and*** **Saneyasu YAMAGUCHI**[†], ***Member***

1. Introduction

Optimizations of reading size and readahead are important for improving the I/O performance in hard disk drives. FHE (Fully Homomorphic Encryption) increases the data size and I/O processing time. In this paper, we discuss the relationship between readahead size, seek distance, and I/O performance in an FHE large I/O application.

2. FHE data mining

Imabayahi et al. proposed an FHE Apriori [1]. In this case, several files are accessed alternatively. In this case, striping layout [2] is effective for decreasing disk seek distance. However, the relationship between seek distance and seek time in alternate I/O has not been studied.

3. Evaluation

We created two 80 GB files, split them into 4371 blocks whose sizes are 937 KB, and stored these files on a 2TB HDD using a striping layout. We executed a set of zig-zag I/O requests and measured time to complete like Fig. 1. In addition, we executed also a set of non-zig-zag I/O optimized by striping layout like Fig. 2. Fig. 3 shows the relationship between the size of each read request and the time to complete a set of I/O requests with the normal and striping layouts. Surprisingly, we can see that time to complete I/O requests increased as the total seek distances decreased in the case of the normal layout. As a result, the normal layout outperformed the striping layout with a large request size. Fig. 4 depicts the relationship with a variety of readahead sizes. We ranged the readahead size from 120 KB to 136 KB. Each line in the figure indicates the readahead size. This indicates that the point of execution time drop depends on the readahead size.

4. Conclusion

In this paper, we investigated the I/O time in aspects of reading size, disk seek distance, and readahead time. Our experimental results showed that an increase in disk reading size sometimes decreases time to complete disk reading time.

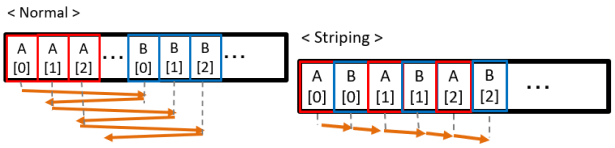

Fig. 1 Normal layout **Fig. 2** Striping layout

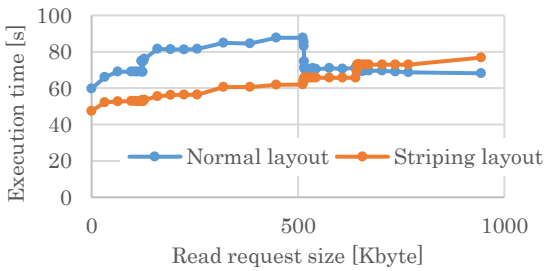

Fig. 3 Read request size and read time (normal and striping layouts)

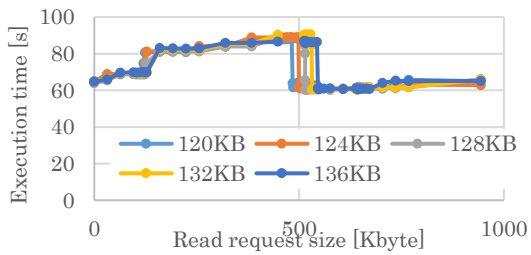

Fig. 4 Read request size and read time (readahead size

Acknowledgments

This work was supported by JSPS KAKENHI Grant Numbers 17K00109, 18K11277. This work was supported by JST CREST Grant Number JPMJCR1503, Japan.

References

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[2] E. Fujishima, K. Nakashima, S. Yamaguchi, "Hadoop I/O Performance Improvement by File Layout Optimization," IEICE Trans. Inf. Syst. 101-D(2): 415-427, 2018. doi: 10.1587/transinf.2017EDP7114

[†]The authors are affiliated with Kogakuin University

[a)] E-mail: cm20016@ns.kogakuin.ac.jp