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Design and evaluation of Hybrid storage system in HEP Environment

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Abstract: Nowadays, the High Energy Physics experiments produce a large amount of data. These data is stored in massive storage system, which need to balance the cost, performance and manageability. HEP is a typical data-intensive application, and process a lot of data to achieve scientific discoveries. A hybrid storage system including SSD (Solid-state Drive) and HDD (Hard Disk Drive) layers is designed to accelerate data analysis and reduce the cost. The performance of accessing files is one of decisive factors for the HEP computing system. The Hybrid storage system can provide a caching mechanism for the server which will improve the performance dramatically. The system combines the advantages of SSD and HDD. It works on virtual block device and the logic block is made up of SSD and HDD. In this way, system gets excellent I/O performance and large capacity with low cost. This paper describes the Hybrid storage system in detail. Firstly, this paper analyzes the advantages of Hybrid Storage System in High Energy Physics, summarizes the characteristics of data access mode, evaluates the performance of different Read/Write mode, then proposes a new deployment model of Hybrid Storage System in High Energy Physics, which is proved to have higher I/O performance. The paper also gives detailed evaluation methods and the evaluations are about SSD/HDD ratio, the size of the logic block, the size of experiment files and so on. In all evaluations, sequential read, sequential write, random read and random write are all tested to get the comprehensive results. The results show the Hybrid Storage System has good performance in some fields such as accessing big files in HEP. Based on the analysis, I proposed an optimization algorithm taking into account a variety of factors including SSD/HDD ratio, file size, performance, price and so on. The Hybrid storage system can achieve better I/O performance with lower price in High Energy Physics, and also be applied in other fields which have a large amount of data.

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