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LHD実験における高速・大容量データ集録の現状と課題
Status and Issues of High-performance Massive-size Data Acquisition and Archiving in LHD

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The newest model of diagnostic high-speed cameras and digital oscilloscopes often generate more than 1 GB raw data by a single pulse plasma experiment at LHD. The LHD data system, namely, LABCOM system has already established about 100 MB/s high-performance real-time data acquisition method for each plasma diagnostics toward the LHD steady-state plasma sustainment. The above-mentioned newest devices, however, need one-digit higher performance for data acquisition and storing throughputs. To satisfy those requirements, overall performance improvements on not only digitizers' throughputs but also the networking topology and I/O performance upgrade for the central storage devices will be indispensable.

In this study, we have replaced the currently operating cloud-based storage system, namely, IznaStor with a simple distributed filesystem 'GlusterFS' toward 2013's annual campaign of LHD. This replacement intends to improve the fault tolerance ability and also the recovery speed from the system failures. Specifically, the storage system has been separated into two layers; one is providing high I/O throughputs with a week long short-term storage space, and the other for the long-term archiving area which also serves nonstop data access service. The former adopts 28 solid-state disks (SSDs) of 14 parallel replicated pairs, which can achieve much improved I/O performance by the increased number of parallel writings. See Fig. 1. This storage structure will have a shorter recovering time from a single disk failure because it needs data re-synchronization only for one disk volume. In addition, the recovery never affects other replica pairs so that the performance degradation will be limited within the minimum bounds.

As Fig. 2 shows, the LHD data continues increasing one digit per about every 5 years, being well fit with the famous 'Moore's law'. Therefore, it is very difficult for one product or technology to keep covering the extension for a long time. In LHD case, the fundamental archiving technologies have been changed in every 4 or 5 years until now. The new GlusterFS system will be the 5th generation. It is planned that the system reliability, availability, and the I/O performance will be substantially verified through the real operation for LHD experiments.

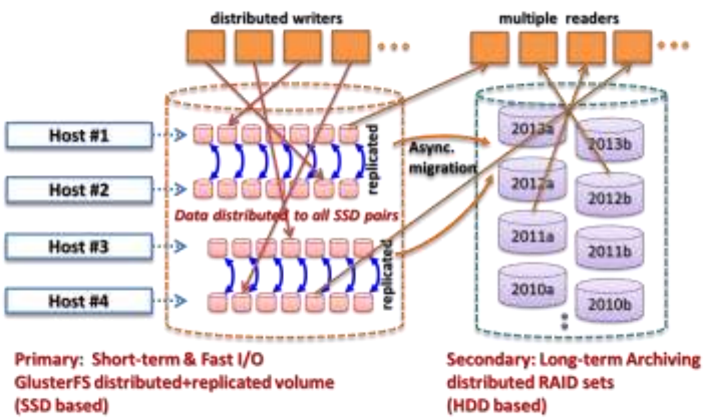

Fig. 1 LHD's new separated storage layers for short-term high-speed one (left) and long-term archiving

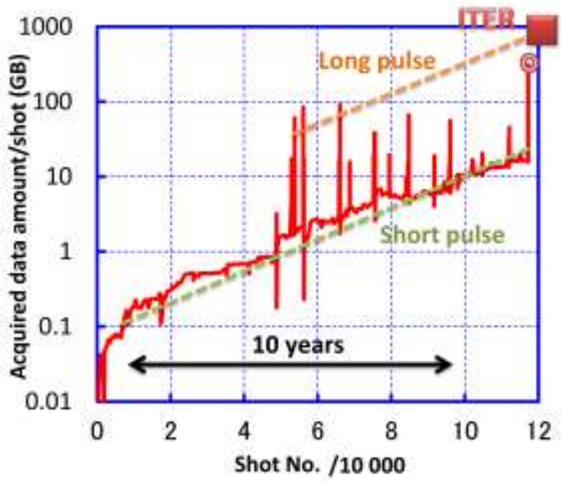

Fig. 2 Acquired raw data amount for every discharge experiment in LHD