Final Project: Implementation of PARAID via DiskSim simulator

Reducing power consumption of storage systems for data centers is important, as the storage accounts for one third of the total energy consumption, let along the energy usage on the heat dissipation and cooling systems. Unfortunately, conventional RAID systems cannot simply reduce power by shutting down some of the disks because loads are balanced to use all disks.

Dr. Weddle designed a mechanism called PARAID in 2007 that reduces energy us of commodity server disks without specialized hardware. The heart of PARAID is a disk striping-skewing scheme that disks can be organized into hierarchical overlapping sets of RAIDs.

As a final project, your job is mainly implementing the PARAID using DiskSim simulator, which is a widely used disk simulator tool. Your work is consisting following few steps:

1. Read the PARAID paper and understand the main idea of the paper. (The paper can be downloaded at https://www.usenix.org/legacy/event/fast07/tech/full\_papers/weddle/weddle.pdf)
2. Download the DiskSim source code and get familiar with DiskSim by playing with it under the guidance of the manual document. All the information related can be found at <http://www.pdl.cmu.edu/DiskSim/>

NOTE: please DO NOT use the 64-bit compliant version that was released by Western Digital.

1. Build a 5-disk RAID-5 model via DiskSim
2. Implement the striping-skewing scheme in PARAID via DiskSim. You are supposed to implement the scheme on a 5-disk PARAID-5 model (power-aware RAID-5)
3. Run tests on both conventional 5-disk RAID-5 and 5-disk PARAID-5 using a synthetic model (Normal Distribution) in terms of I/O performance (response time, bandwidth, latency)
4. Finish the project report. The report should at least includes the following parts:
   1. The review of DiskSim
   2. The summary of PARAID’s main contributions
   3. The details in implementation using DiskSim and the experimental settings
   4. The evaluation of the results
   5. What you are inspired by the PARAID paper? If you are asked to process a development based on PARAID, what do you plan to do?
5. ExtraJob1 (20%): if you can develop a energy consumption analysis module in DiskSim and apply it to compare power consumption between RAID-5 and PARAID-5, you will get extra 20% points towards your final project score. In order to gain the extra points, you have to make sure that your codes are easy to ready and is available for later use. Comments, README file and Github, etc could be some solutions in terms of taking care of your codes.
6. ExtraJob2 (5%): if you are using Latex and write your project report in a technique paper manner (using IEEE conference template, go find by yourselves), you will get extra 5% points towards your final project score. In order to gain this 5% points, you have to carefully organize your report and present your results along with evaluation. You may use to the PARAID paper as a good reference.
7. If you can finish both the ExtraJobs in a good way, you will gain in total 35% extra points towards your final report. However, please keep in mind that quality over quantity, meaning even thought you finish the both the ExtraJobs, if they do not meet the requirement, you might have a chance not gaining the full 35% points, or, in a severe case, not gaining any extra point at all.