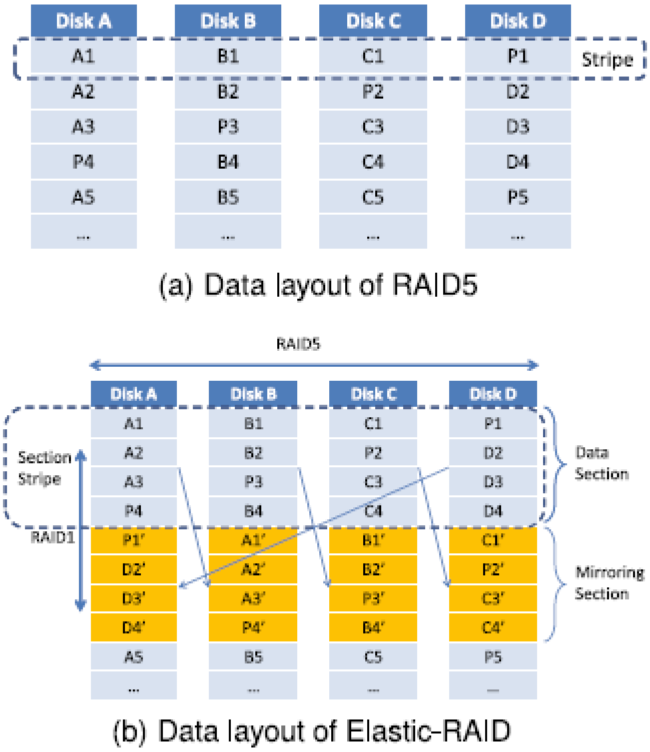
The RAID system is common using in the server when it has contained multiple hard disks array. In typical case, the server has implemented the RAID level 1, 10, 5 or 6 which is according to the number of hard disks and data storing layout. The mainly function is prevented the data loss during disk failure and increased I/O performance.

Due to the large set of hard disks array, it should install over 6 disks and increase the failure rate of two disks or more simultaneously, such as SAN or enterprise class NAS. Certainly, it is not suitable to implement for the traditional RAID system, because this RAID system is only allowed at most two disks failure simultaneously for RAID 6. If the failure disk is more than two, all data has gone and cannot recovery again. Thus, the authors have proposed Elastic RAID architecture to achieve high performance and reliability for large-scale parallel and distributed storage system, the key idea is smartly allocated the free space existing in parity-based disks array (RAID 5, RAID 6) to store addition mirroring data (RAID 1) without any additional hardware capacity. The mainly benefits are including to tolerate a minimum of two disks or maximum of n/2 disks failure where n is total number of disks in RAID 5,[fig. 4] in case of the free space is equal to or more than half of the total capacity. It is increased I/O performance during reconstruction state of RAID system, because the mirror data can recover the data section when the RAID 5 system has more than one disk failure. Otherwise, the data and parity need to recalculate on the spare disk when the I/O performance of other on-line disks have extremely low during the degraded mode. [formula 1]

For the Elastic-RAID architecture, it has added some functional modules to the traditional parity-based RAID system which is exploited free space for improvement of reliability and efficiency, including address convertor, mirroring manager and I/O optimizer. The I/O optimizer is designed to optimize the small-write performance for exploiting of mirroring data which is implemented the performance oriented design strategy, the write operation is writing original data in RAID 5 and the duplicating data have wrote the mirroring part synchronously when the process of updating parity data late and loading period have executed in the background. This strategy is estimated to the number of I/Os where is difference from the performance upper bound and lower bound of RAID 0, the small write request will generate which is according to the number of internal I/Os from these two bounds. The r/w data and parity do extracted in two RAIDs system simultaneously, instead of one RAID system. For the reliability oriented design strategy, it is similar to the performance oriented design strategy. The upper bound is two-disk-failure tolerance, but the lower bound is decreased the small write performance. As a proportional fraction of the data chunks can be protected by mirroring and parity redundancy simultaneously, when the free space is low than half of total capacity.

The AutoRAID is selectively storing data chunks and using non-uniform length stripes for either the RAID1 or RAID5 set, it is caused more overhead to migrate data in two different RAID sets. However, the Elastic-RAID uses a uniform section stripe for both original data and mirroring data. This design reduces the complexity of implementation.



(a) Data layout of RAID5

(b) Data layout of Elastic-RAID

Fig. 4. Data layouts of RAID5 and elastic-RAID.

Formula 1: Rio_amp = IOInternal / IOUser, if RAID 5 has failure for single disk, the value of I/O ratio is decreased = n-1 where n is the number of disks in RAID 5. In Elastic-RAID, the ratio could not be changed and the value is 1 as extract data from mirroring section.

Yao, J. et al., 2016. Elastic-RAID: A new architecture for improved availability of parity-based RAIDs by elastic mirroring. *IEEE Transactions on Parallel and Distributed Systems*, 27(4), pp.1044–1056.

Prof. LEUNG comment

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Sai Ho CHEUNG Jan 2

Dear Sophia would u pls pass my latest version of FYP spec and summary of res...

Sophia Cheng <sophiacheng@comp.hkbu.edu.hk> Jan 3

to me

Dear Sai Ho,

Your updated FYP spec and summary have been passed to Prof. Leung. Thank you.

Best Regards,
Sophia

From: Sai Ho CHEUNG [mailto:15451682@life.hkbu.edu.hk]
Sent: Monday, January 02, 2017 9:48 PM
To: Sophia Cheng <sophiacheng@Comp.HKBU.Edu.HK>
Subject: summary of research thesis from CS website

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Yiu-Wing Leung Jan 13

to me, Sophia

Dear Saiho,

Thank you for your reports. I am not familiar with the topic on big data technique. I suggest you contact any one of the following professors: Prof. J. Xu, Dr. Byron Choi, Dr Lisi Chen.

Regarding your report on RAID, it is a nice summary of the research paper. If you want to work on MSc Research on this topic, I suggest that you try to think about the possibility for improving the existing RAID methods. Good research results include one or both of the following: i) new problem (e.g., the paper presents a new problem in which the free space in the hard disks is utilized to improve data availability), ii) new solution (e.g., a new method to further improve elastic RAID).

Thank you.

YW Leung