Enhancing Shared RAID Performance Through online Profiling

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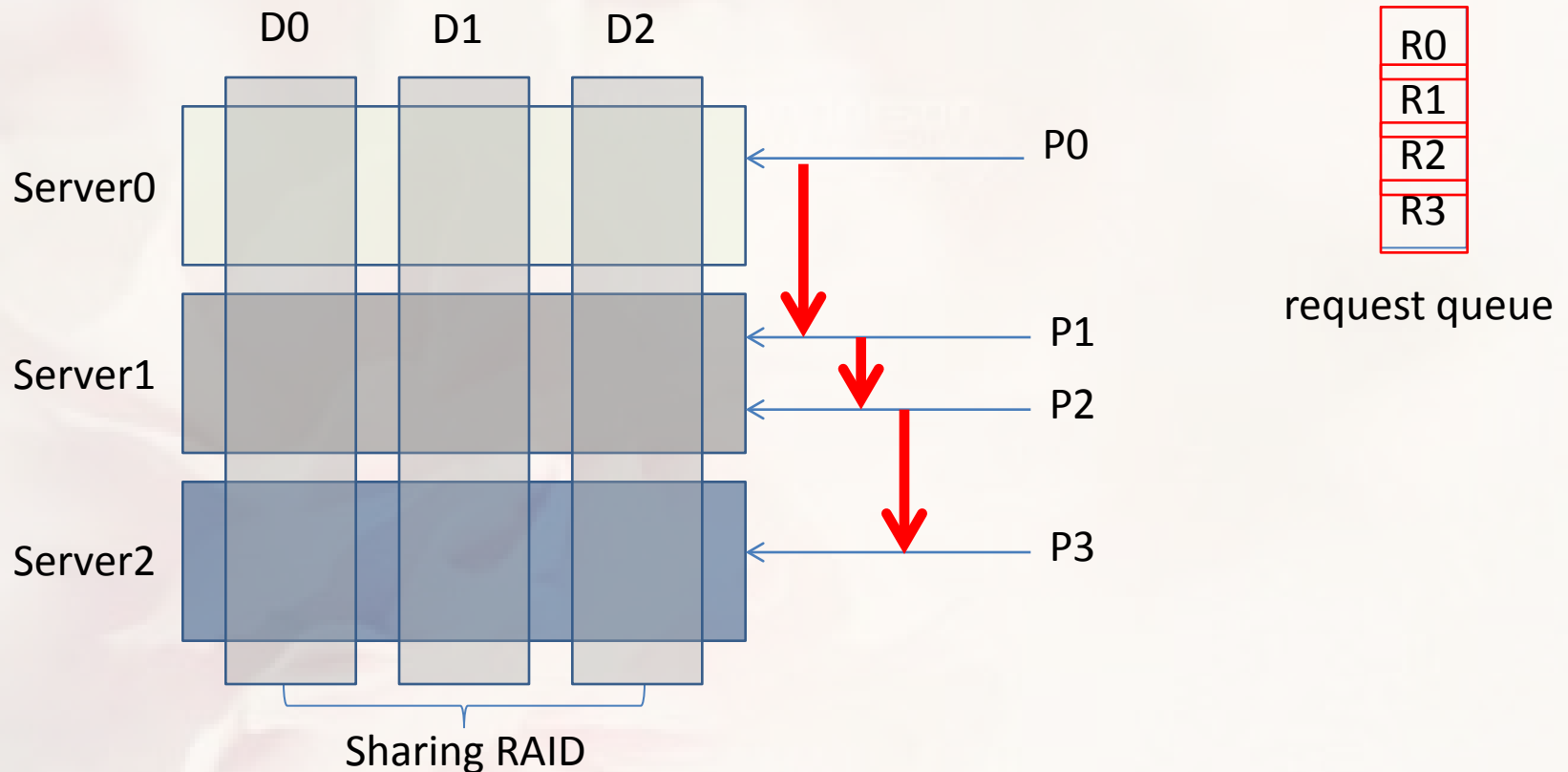Jianzong Wang[+], Changsheng Xie[*]

[*]Wuhan National Laboratory for Optoelectronics
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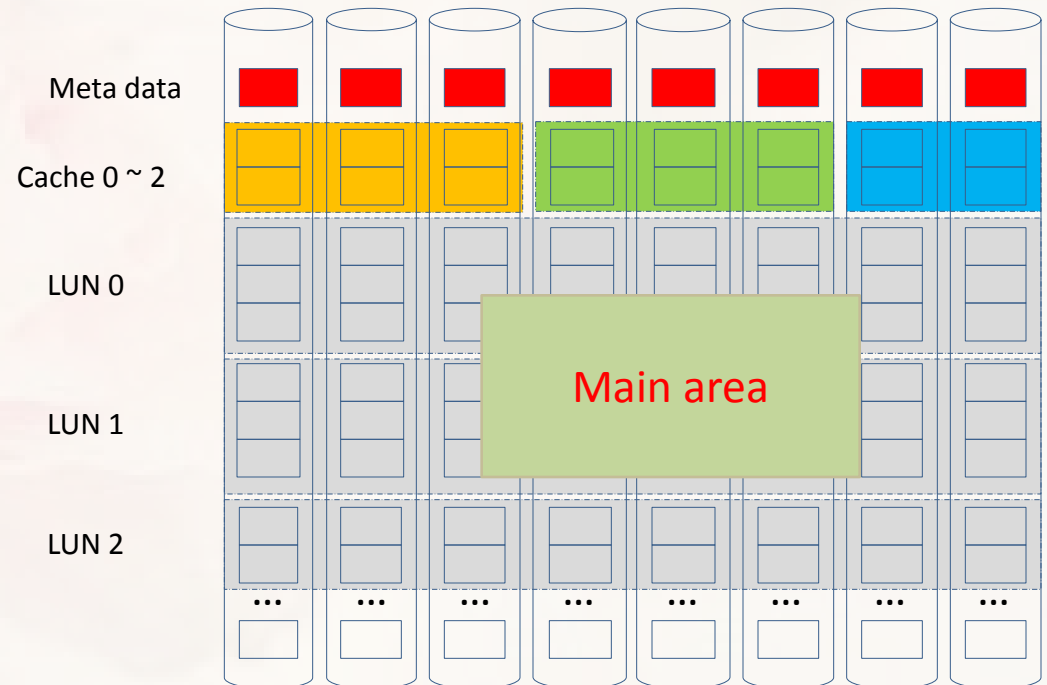[§]University of Rhode Island

Sharing storage problem

Disk heads cross about the whole disk
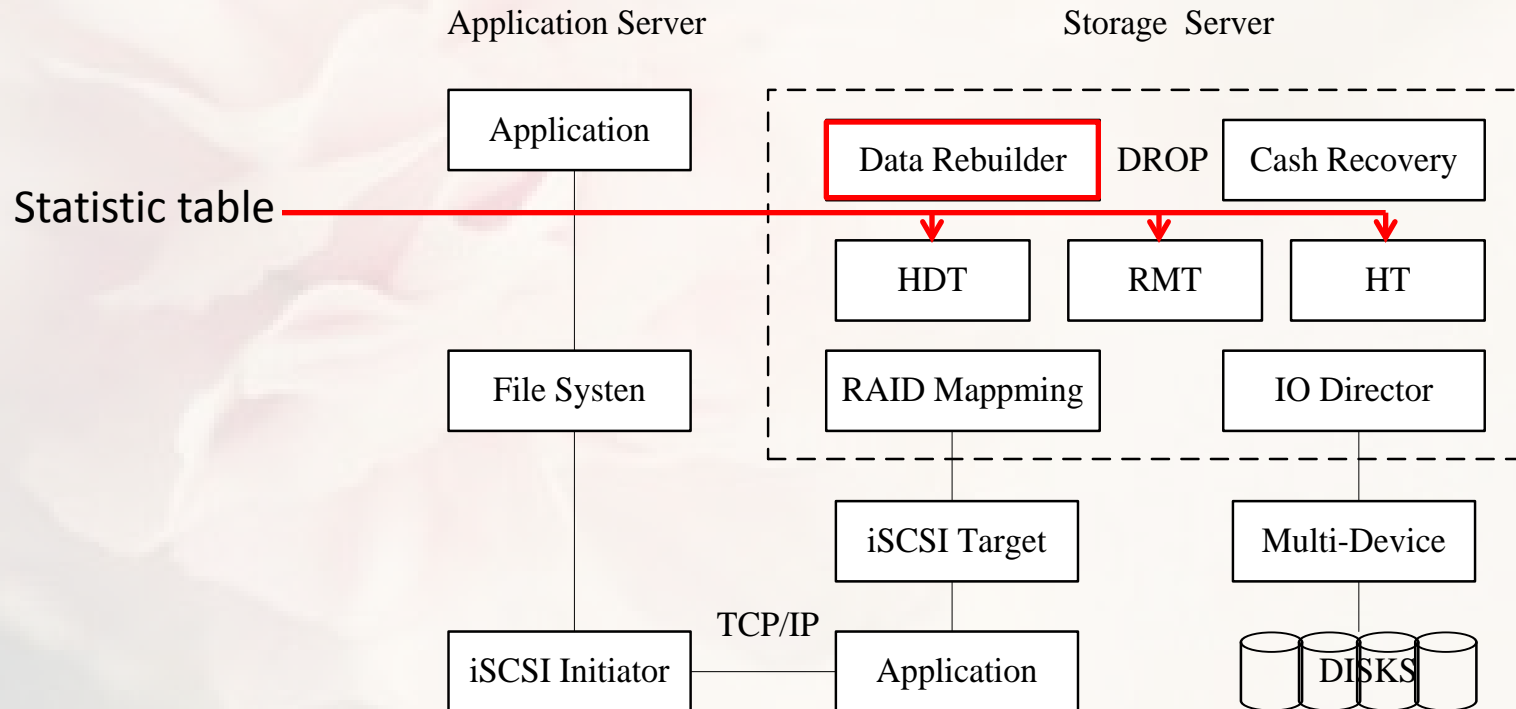
How to solve this?

DROP design(1)

□ DROP features

- ◆ RAID cache structure
- ◆ More cache space
- ◆ Permanently resident
- ◆ Reliability

Meta data

Cache 0 ~ 2

LUN 0

Main area

LUN 1

LUN 2

DROP design(2)

Online Profiling

☐ Hot data profetching

- ◆ 10% of data blocks

- ◆ Adjacent blocks are also profetched(two blocks)

☐ Software structure of DROP

Application Server   Storage Server

| Application | | Data Rebuilder | DROP | Cash Recovery |

Statistic table ——————————————————————————————

| HDT | | RMT | | HT |

| File Systen | | RAID Mappming | | IO Director |

| iSCSI Target | | Multi-Device |

TCP/IP

| iSCSI Initiator | | Application | | DISKS |

Workload features

◆ The *GIS traces* were collected from real world environment

◆ *GIS* has a storage shared by 3 servers: a database server, a multimedia server, and a web server. They store mainly geographical information (GIS) of an area similar to a large city.

◆ The total address space span is over 1 terabytes, only a few gigabytes hot-spot

◆ the percentage of daily repeated accesses ranges from 46% to 77%

◆ Dedicated disk allocation scheme：*average seek distance is 1389*

Sharing allocation scheme：*average seek distance is 6027*

Characteristics of Sharing IOs

we analysis the sharing problem based on the real world traces from three aspects:

☐ Hot-spot data percentage

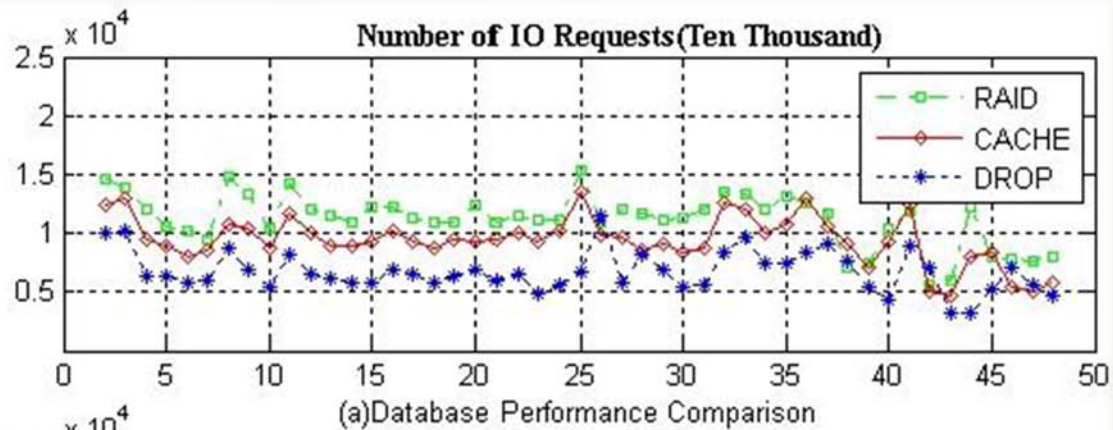☐ Data block locality and spatial locality

☐ Head seek distance

Evaluation
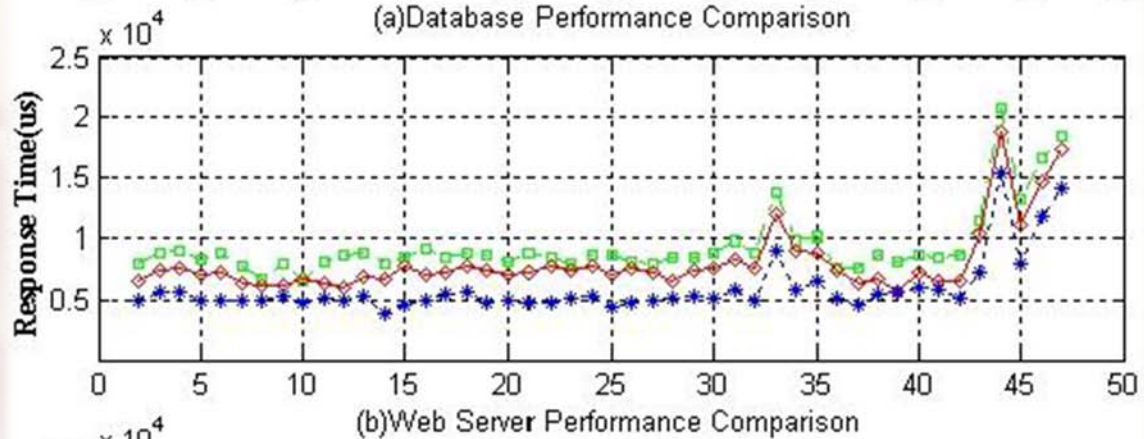
☐ Baseline System

◆ We evaluate the performance of *DROP* in comparison with two baseline systems

◆ *RAID* is the traditional shared RAID with no data relocation and disk caching mechanism used

◆ *CACHE* uses data relocation and disk caching mechanism similar to prior research reported in *BORG* [Bhadkamkar '09]
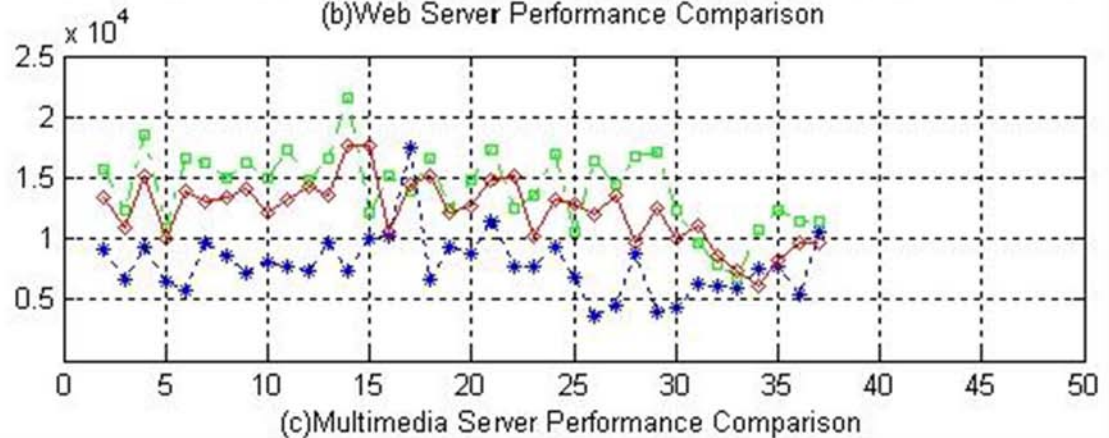
Evaluation

74%

63%

96%

(a)Database Performance Comparison

(b)Web Server Performance Comparison

(c)Multimedia Server Performance Comparison

Thank you!