

A New High-performance, Energy-efficient Replication Storage System with Reliability Guarantee

Chao Yin

Huazhong University of Science and Technology

This talk is based on the following paper: Jiguang Wan, Chao Yin, Jun Wang and Changsheng Xie, "A New High-performance, Energy-efficient Replication Storage System with Reliability Guarantee," Proceedings of 28th IEEE Conference on Massive Data Storage (MSST2012), April 16th-20th, 2012

Outline

- 1 **Motivation**
- 2 **PERAID**
- 3 **Test Result**
- 4 **Conclusions**

Motivation

- ❖ With the rapid growth of data production in companies, the requirement of storage space grows very largely.
- ❖ Data storage is important in many fields banking, financing industry, government
- ❖ **Ideal system:**
 - High performance;
 - Reliability;
 - Energy-efficient.

Contribution

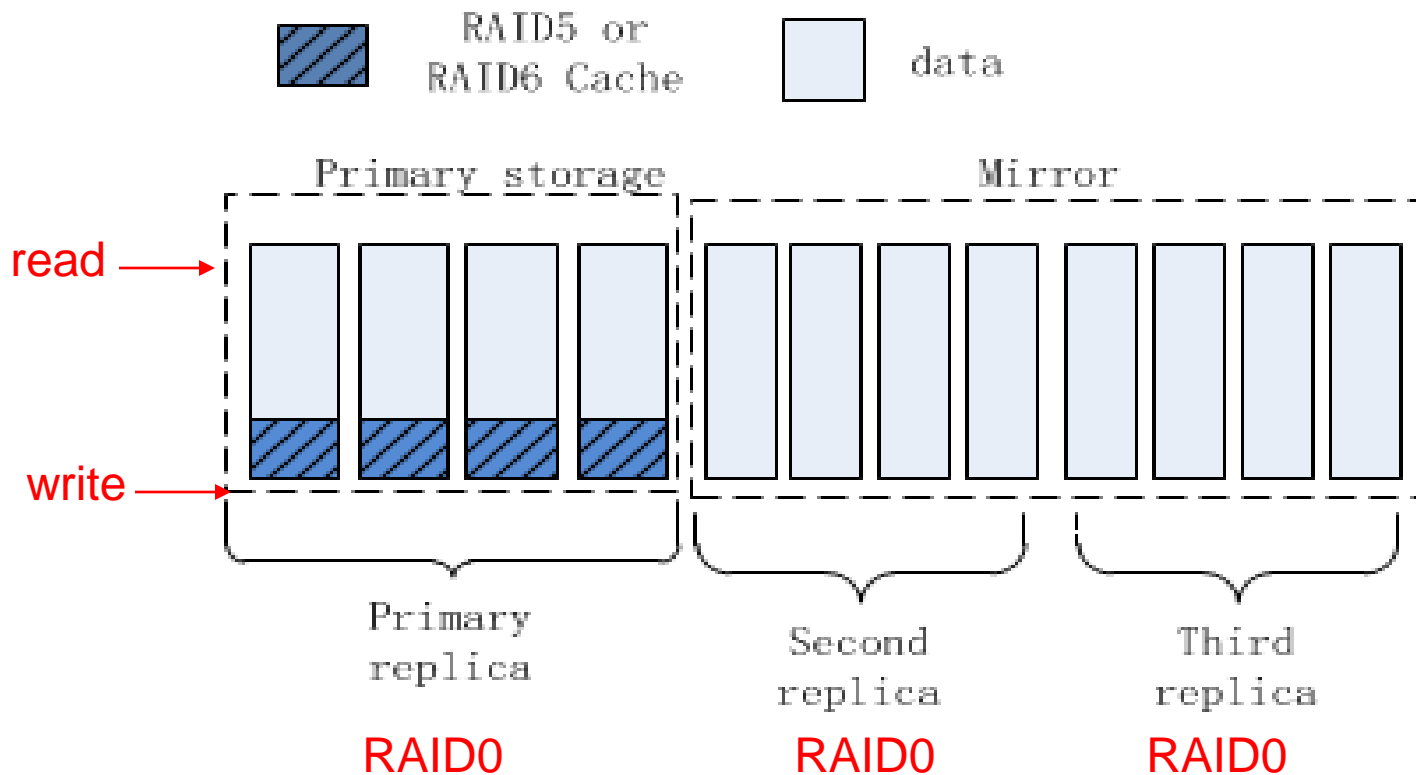
- ❖ **Provide ideal reliability of new data and old data, improve the performance, decrease the energy consumption**
- ❖ **high write-to-read-ratio I/O workloads**
ratio↑, performance ↑
- ❖ **Random write I/O workloads**
write buffer size ↑, energy consumption↓

Outline

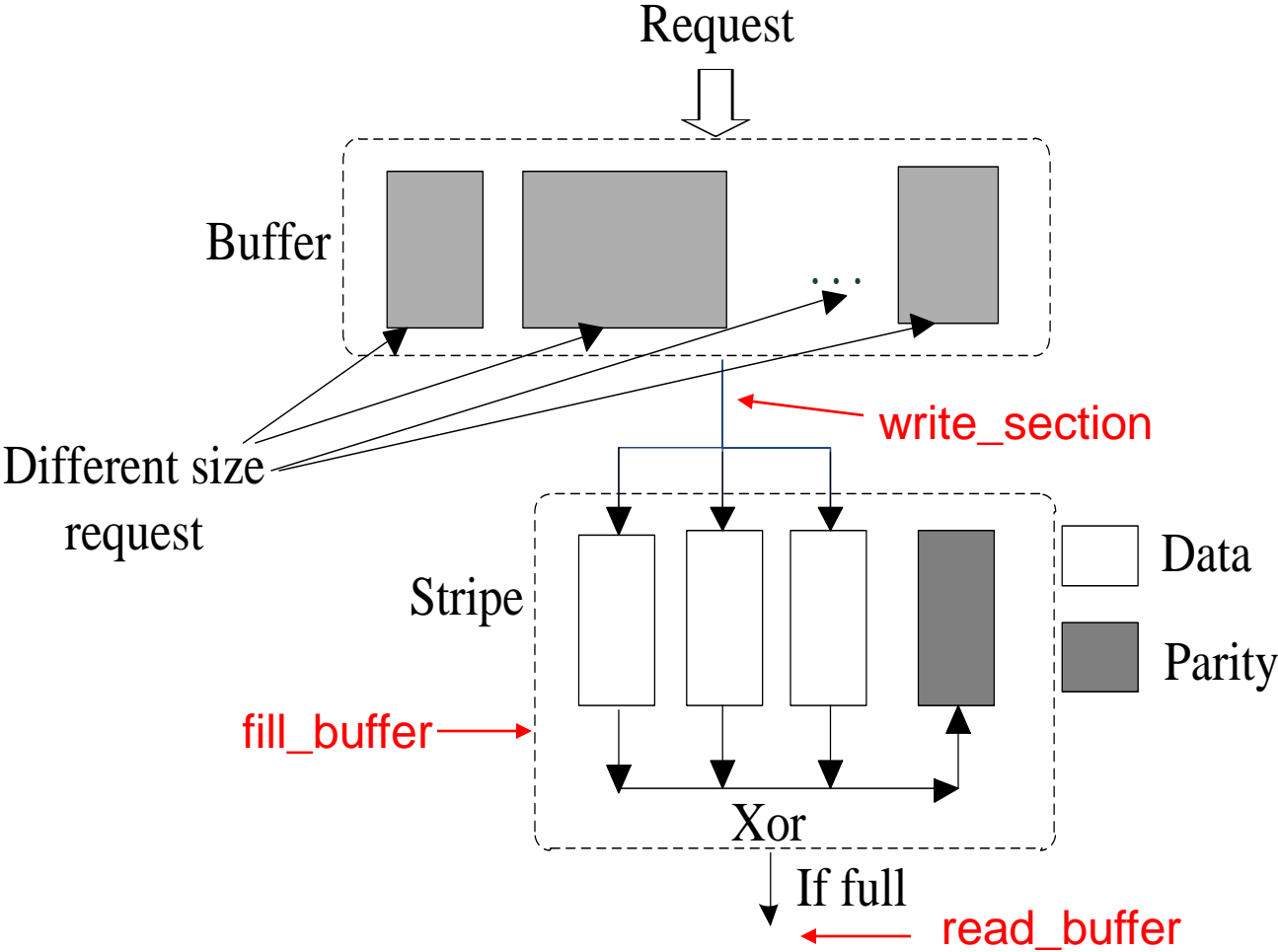
- 1 **Motivation**
- 2 **PERAID**
- 3 **Test Result**
- 4 **Conclusions**

PERAID

The Design of PERAID

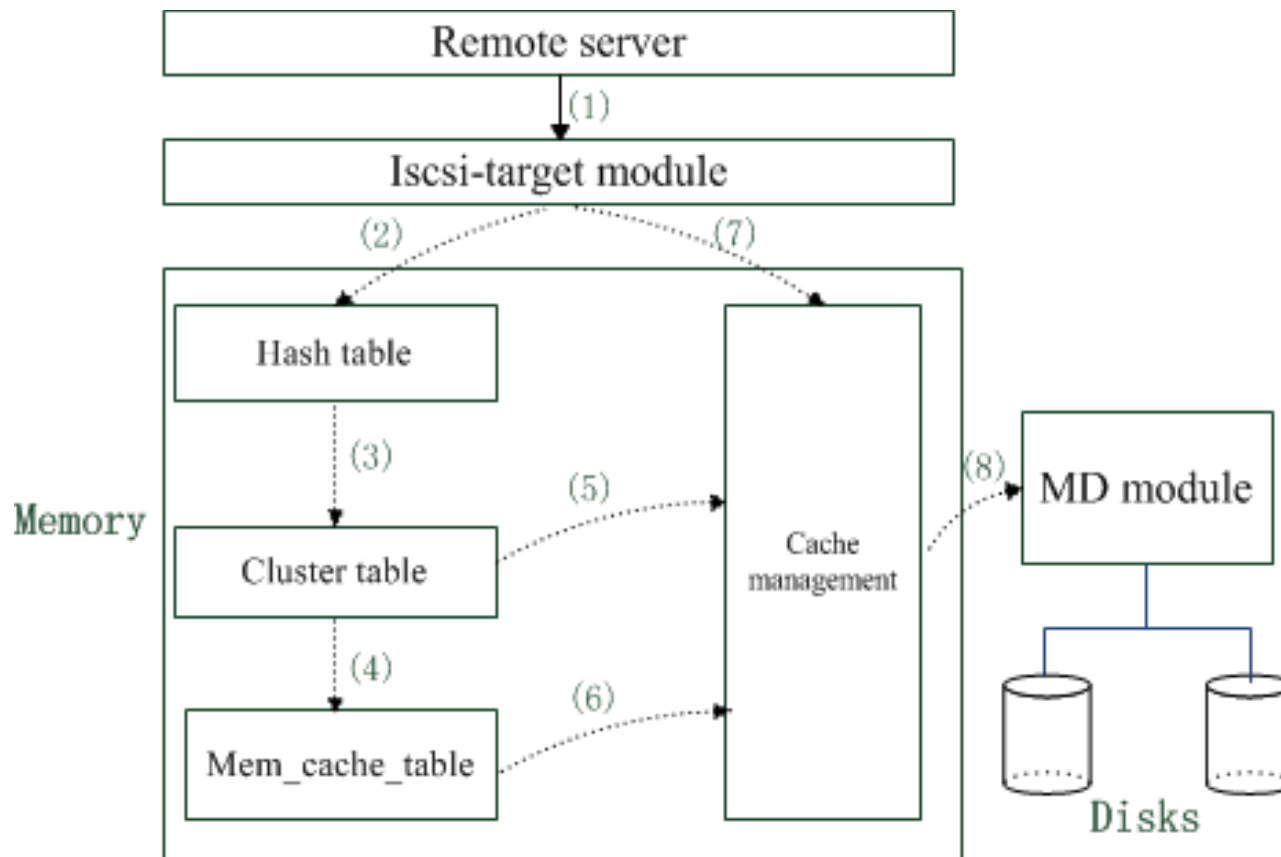


SRWLW: Small Random Write to Large Write



PERAID

The Prototype of PERAID

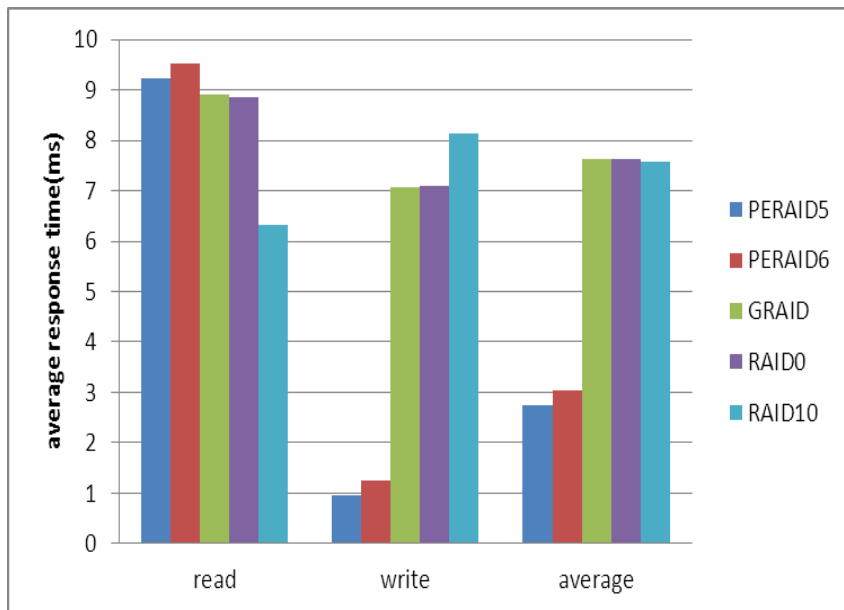


Outline

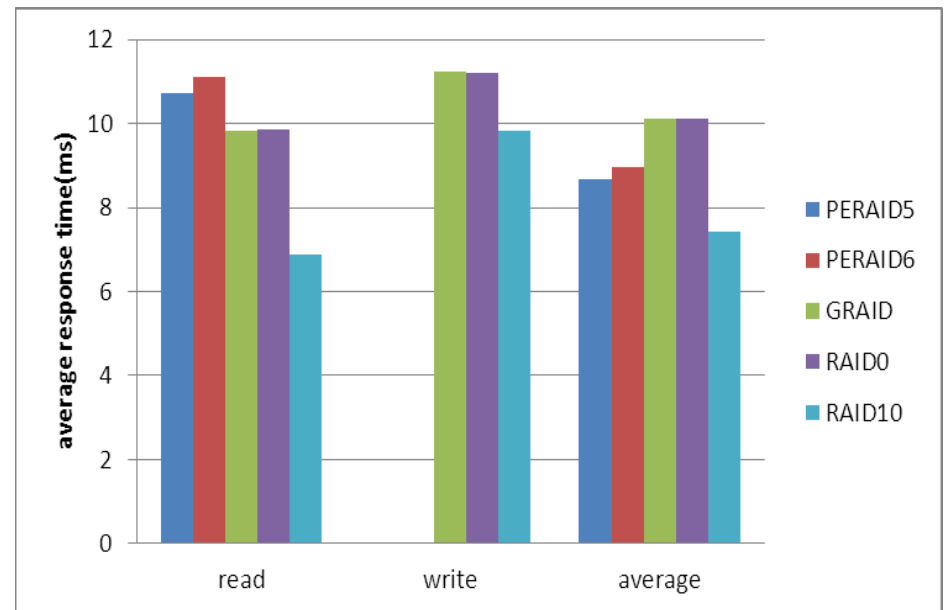
- 1 **Motivation**
- 2 **PERAID**
- 3 **Test Result**
- 4 **Conclusions**

Performance Test Result(1)

Trace File	Write Request Ratio	Average Request Size (KB)	Total Request Number
Financial-1	76.84%	3.38	5, 334, 987
Financial-2	17.65%	2.39	3, 699, 195



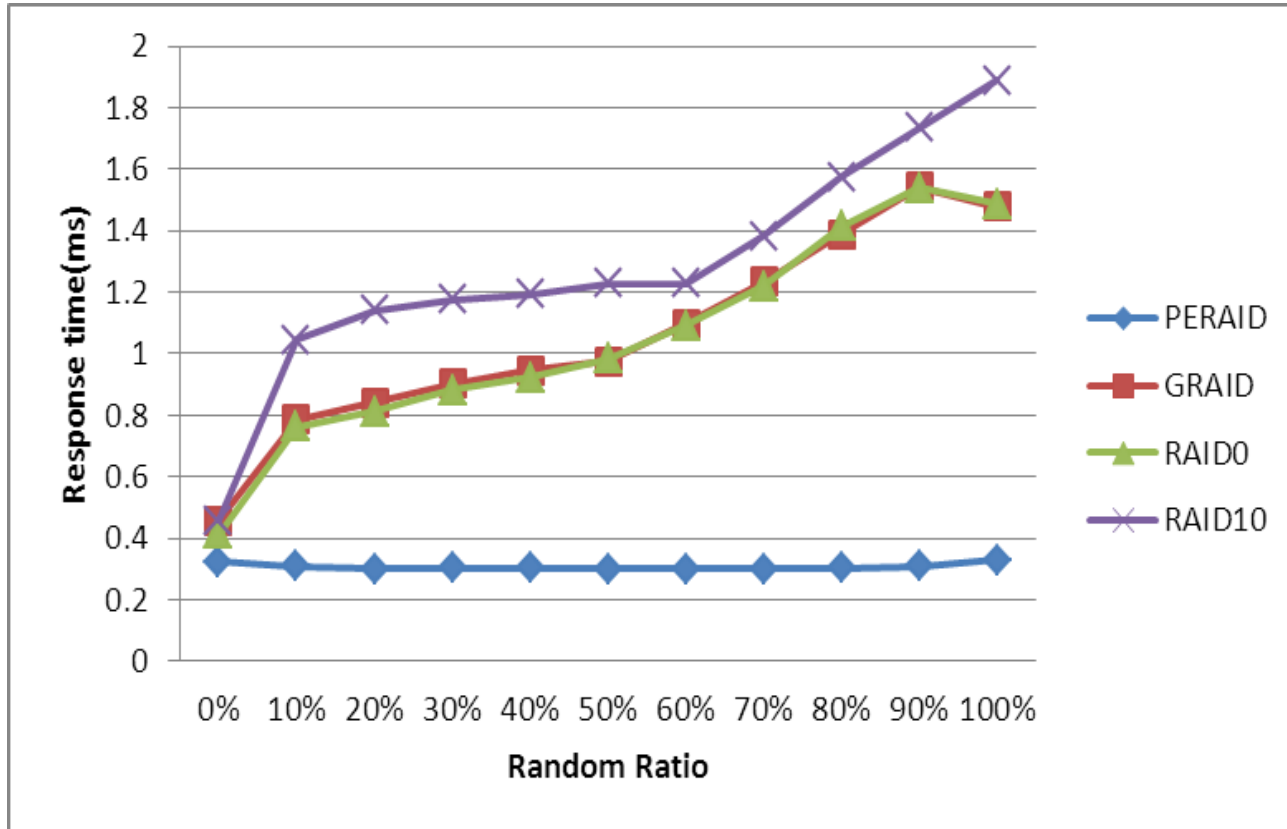
Financial-1



Financial-2

Performance Test Result(2)

❖ tool Iometer, write ratio 100%, request size 4KB



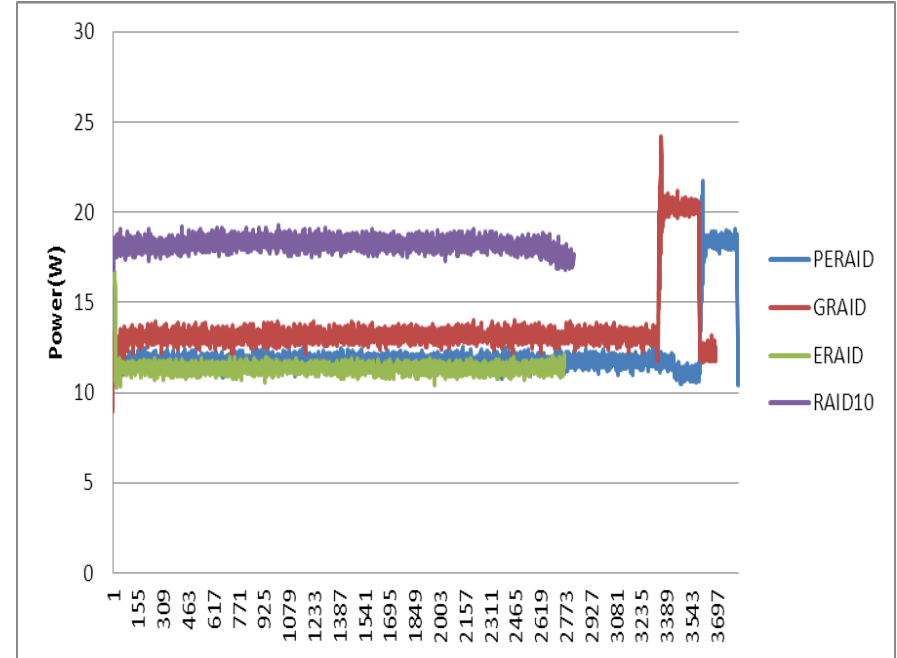
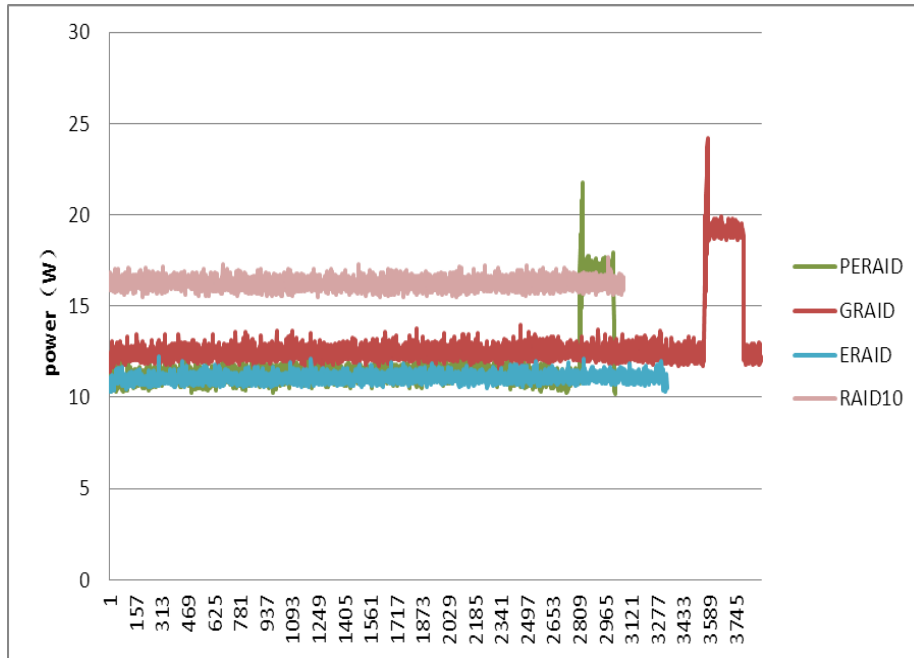
78.1% GRAID

74.4% RAID0

79.4% RAID10

The random ratio will have no effect on PERAID

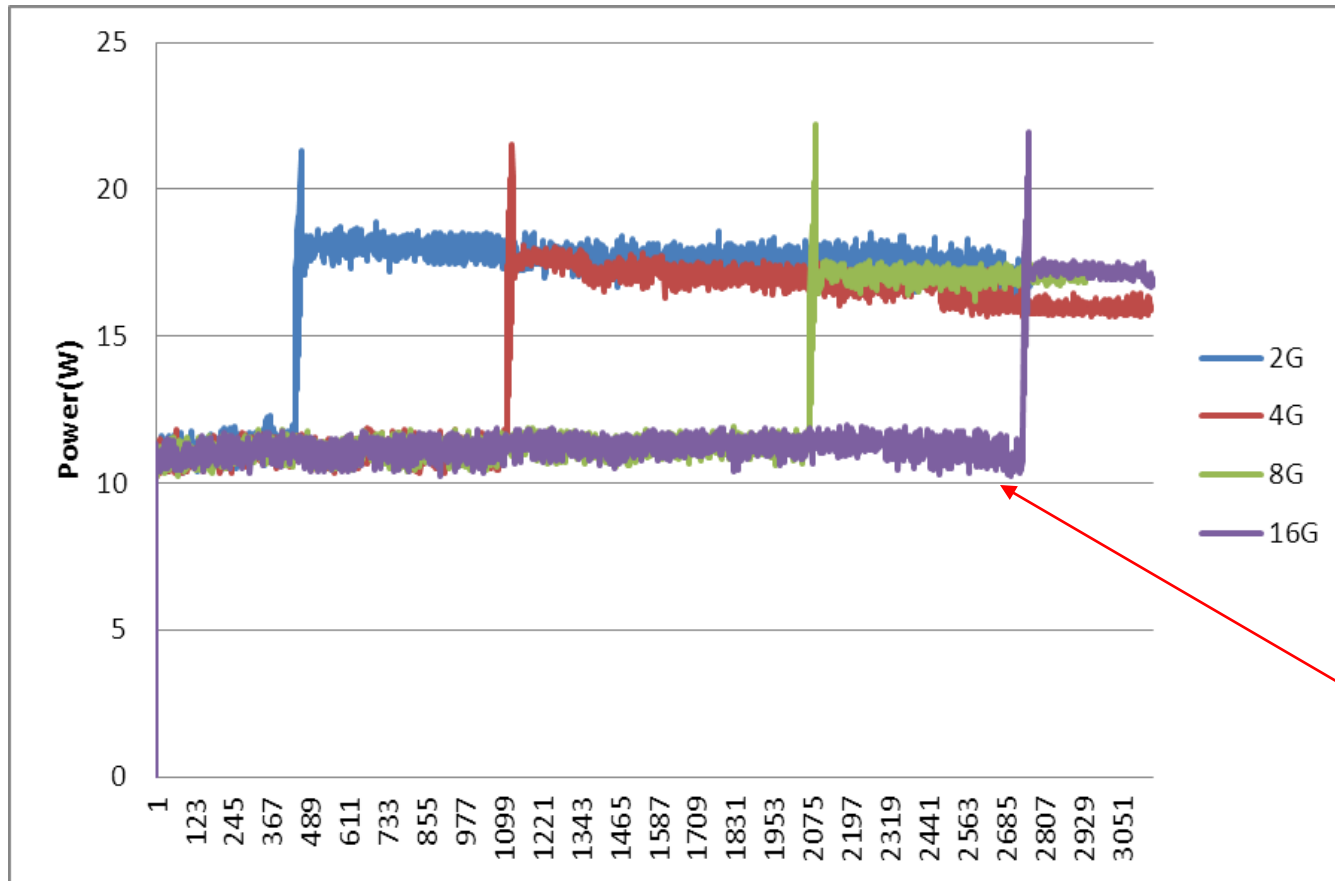
Energy consumption Test Result(1)



Sudden increase curve because the system flushes the disk

Energy consumption Test Result(2)

❖ Energy consumption when flushing disk



4.3% 8G

21.1% 4G

26.9% 2G

Flush time will delay

The cache of 16G is the most energy-efficient

Summary on Various Disk Array

Scheme	Performance	Energy Efficient	Reliability
PERAID	1	2	2
GRAID	3	3	3
RAID10	4	4	1
ERAID	2	1	4

The composite score of PERAID is the highest

Outline

- 1 **Motivation**
- 2 **PERAID**
- 3 **Test Result**
- 4 **Conclusions**

Conclusions

❖ This paper presents a storage system: **PERAID**

- high-reliability
- high-performance
- energy-efficient

Acknowledgements

- ❖ **the National Basic Research Program (973) of China (No. 2011CB302303), the National Natural Science Foundation of China (No. 60933002), the Natural Science Foundation of Hubei province (NO. 2010CDB01605), the HUST Fund under Grant (Nos.2011QN053 and 2011QN032), the Fundamental Research Funds for the Central Universities, the US National Science Foundation Grant CCF-0811413, CNS-1115665, and National Science Foundation Early Career Award 0953946**



Thank You !

More information:

Chao Yin, yinchao408@gmail.com

**STAR: Huazhong University of Science and
Technology**