

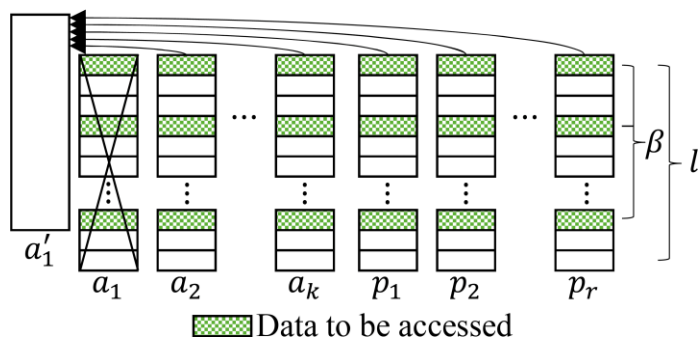
MDS Array Codes with Low Disk I/O and Small Repair

Lei LI, Chenhao YING, Liang CHEN, Yuanyuan DONG,
Jie LI, Yuan LUO

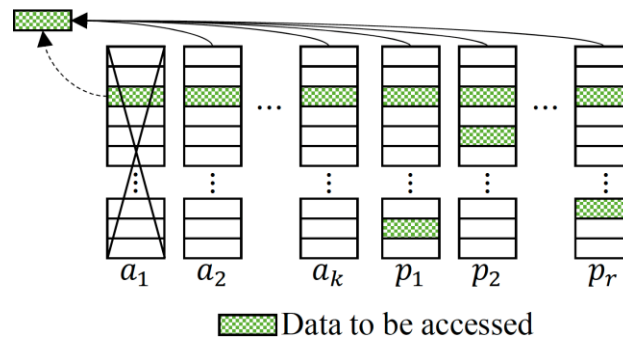
Frontiers of Computer Science, DOI: [10.1007/s11704-024-3581-7](https://doi.org/10.1007/s11704-024-3581-7)

Problems & Ideas

- Problems of minimum storage regenerating codes:
 - Exponential sub-packetization level of MSR codes results in complex metadata management.
 - Massive disk I/O consumption makes the practical performance of MSR codes far from expected.
- Ideas: Constructing MDS array code under small sub-packetization level in field \mathbb{F}_{256} .



(a) Node repair of MSR code

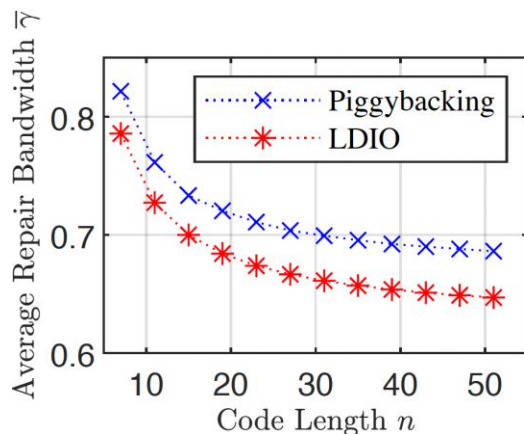


(b) Degraded read of MSR code

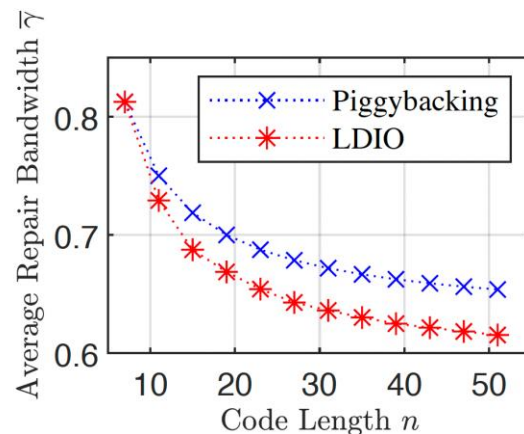
Node repair and degraded read of MSR code. (a): A massive amount of non-sequential data access (disk I/O) during node repair; (b): Multiple disk I/Os on some helper nodes during degraded read.

Main Contributions

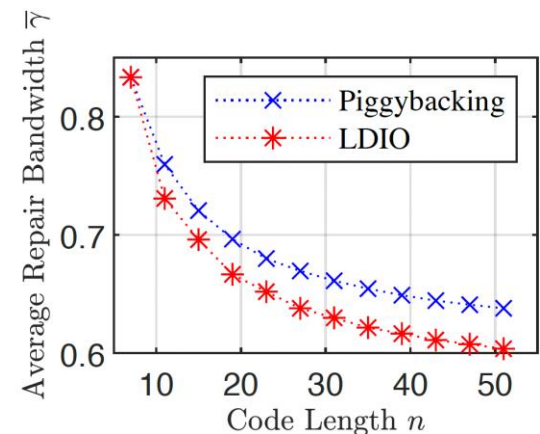
- Contributions:
 - A novel construction of MDS array code with very small sub-packetization level of $l = r$ or $l - 1$ divides $r - 1$, i.e., $l = O(r)$;
 - MDS array codes in field \mathbb{F}_{256} constructed via computer program;
 - A method to obtaining the MDS property for the array codes by field extension.



(a) Redundancy $r = 3$



(a) Redundancy $r = 4$



(a) Redundancy $r = 5$

Average repair bandwidth of Piggybacking and LDIO codes for (a) $r = 3$, (b) $r = 4$, and (c) $r = 5$.