TECHNOLOGY
Method of Optimal Data Repair in Distributed Storage

OVERVIEW

Distributed storage systems are widely used for data storage, with applications ranging from social networks to file and video sharing. Currently deployed systems are formed of thousands of individual drives (nodes), and drive failures occur on a daily basis. For this reason, companies utilizing or providing distributed storage solutions have increasingly turned to error correcting coding for efficient recovery of data stored in the system. The coding method of choice used for data protection relies on Maximum Distance Separable (MDS) codes which provide the maximum failure tolerance for a given amount of storage overhead. The distributed nature of the system introduces new challenges in the code design that are related to the need to communicate data between the nodes during the repair of node failures. Efficient operation of the system requires minimizing the repair bandwidth, i.e., the amount of data that needs to be downloaded to repair the contents of the failed node(s).

Researchers at the University of Maryland working on MDS codes for distributed storage have focused on codes with minimum repair bandwidth, specifically on high-rate MDS array codes with optimal repair property. Explicit constructions of such codes are only available for the cases where there are at most 3 parity nodes, and these existing constructions can only optimally repair a single node failure by accessing all the surviving nodes. Two explicit constructions of MDS array codes are presented in detail with optimal repair property. The code given by the first construction has low complexity of encoding, decoding, repair of failed nodes, and update procedures. The code given by the second construction has the optimal access property and can be constructed over any base field. The codes given by both constructions have the optimal error resilience capability when repairing failed nodes.

APPLICATIONS

· Social networks
· File sharing
· Photo and video storage
· Electronic health records

ADVANTAGES

· Minimum repair bandwidth
· Helps to ensure efficient operation of the system
· Optimal error resilience capability

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PATENT STATUS

Pending

CATEGORIES

- Engineering
- Software + Algorithm

EXTERNAL RESOURCES

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