Coiled Staircase LRC:
Robust Locally Repairable Codes for Distributed Archival Storage

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Because storage media are susceptible to failures, any storage system that must not lose data needs a system allowing to recover from such failures. Distributed storage systems require a balance between storage overhead, reliability and restore data volume in such a recovery system. Because replication and Reed-Solomon codes do not achieve such balance, locally repairable codes (LRC) were developed.

We present novel codes that are specialized for use in distributed archival storage systems. This specialization allows us to trade update cost for reliability by using a recurrent code that are prominently used in optical communications. We make that construction practical for distributed storage systems by adding local parities to create a LRC and by bounding a normally unbounded recurrent code. We show obstacles that arise from that combination and present how to overcome them in a practical system.

To show the performance of our codes we compare them under equal parameters to Reed-Solomon codes and the Xorbas and Azure locally repairable codes. We develop a distributed storage system based on Redis and implement the compared codes ourselves. The results show that our codes need comparable repair bandwidth at equal storage overhead while offering higher reliability.

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