Robust and Efficient Data Management for a Distributed Hash Table

by

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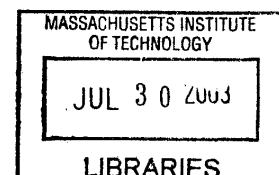. . . . .
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Abstract

This thesis presents a new design and implementation of the DHash distributed hash table based on erasure encoding. This design is both more robust and more efficient than the previous replication-based implementation [15].

DHash uses erasure coding to store each block as a set of fragments. Erasure coding increases availability while saving storage and communication costs compared to a replication based design. DHash combines Chord's synthetic coordinates with the the set of fragments to implement server selection on block retrieval.

DHash enhances robustness by implementing efficient fragment maintenance protocols. These protocols restore missing or misplaced fragments caused by hosts joining and leaving the system.

Experiments with a 270-node DHash system running on the PlanetLab [1] and RON [4] testbeds show that the changes to DHash increase the rate at which the system can fetch data by a factor of six, and decrease the latency of a single fetch by more than a factor of two. The maintenance protocols ensure that DHash is robust without penalizing performance. Even up to large database size, the per host memory footprint is less than 10 MB and the per host network bandwidth is under 2 KB/sec over a wide range of system half-lives.

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"Of the gladdest moments in human life, methinks, is the departure upon a distant journey into unknown lands. Shaking off with one mighty effort, the fetters of Habit, the leaden weight of Routine, the cloak of many cares and the slavery of Home, one feels once more happy."

Sir Richard Burton - Journal Entry - 1856

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