Abstract

This paper describes an approach to distributed file sharing that attempts to balance varying requirements for availability and consistency among different clients in the network. Traditional homogenous consistency models are not ideal for distributed file systems because different clients may have different preferences regarding fault tolerance of different parts of the system – some may prefer to impose strict consistency requirements at the expense of availability while others may prefer for a file to be available, sacrificing consistency if necessary. Even within a specific client, these preferences may vary from file to file. Our approach allows for dynamic control over the desired strength of consistency on a per-directory basis, thus allowing clients to specify individual consistency preferences rather than requiring a uniform level of consistency across the entire network. We also implement a simple file sharing system based on the Kademlia DHT that illustrates this concept in a practical scenario.

Introduction

The tradeoff between fault tolerance and consistency in distributed systems has been explored at length in existing research and is one of the key problems in this field. Most research, however, focuses on network-wide policies for consistency. Our goal was to find a way to balance availability and consistency by managing consistency requirements on a per-client and per-directory basis, rather than requiring a uniform policy across the network. This should allow clients more flexibility to account for individual preference. Assuming that clients make rational and informed decisions with respect to their consistency preferences, our approach should increase availability compared to strict consistency while keeping those files that the client cares about consistent. Stribling et al. explore a similar idea in their paper on *WheelFS*, a distributed file system that allows application control over consistency via *Cues*, special identifiers that are inserted directly into a path name and – as the name suggests – provide hints regarding an application’s preferences with respect to particular files or directories[[1]](#endnote-0).

Approach

Our distributed file sharing system is based on the Kademlia DHT. It allows for both traditional single-file sharing – that is, downloading a specific copy of a single file from the network – and sharing of directories, with the option of specifying which subdirectories to receive update notifications for. Network transfer is implemented via TCP; a file, which consists of a file header that records file metadata and a list of data blocks, is exchanged over the network through parallel transfer of blocks. Directories are conceptually just a special type of file containing a list of its subdirectories and files.

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1. http://news.cs.nyu.edu/~jinyang/pub/wheelfs-nsdi09.pdf [↑](#endnote-ref-0)