HyFS: A Highly Available Distributed File System

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Abstract

HyFS *is designed to employ erasure codes to build a highly available distributed file system. It implements a general framework to use any erasure code. Thus, by applying different erasure codes,* HyFS *offers high flexibility for customizations to meet various application requirements.*

1 Introduction

Building highly available distributed file systems is crucial to any commercial or scientific application. Most current fault tolerance file systems use replication as their redundancy scheme. Hence, they suffer from the high cost of the hardware and manpower needed for it's maintenance. Therefore, we propose a new file system *HyFS*, which is a part of our *Hydra* platform [1]. *HyFS* employs erasure codes to achieve high availability for the underlying unreliable storage systems. When failures occur in the storage nodes, *HyFS* is capable of maintaining the file system usability. *HyFS* implements a general framework so that any erasure code can be used. Thus, users can plug in any interesting erasure code into *HyFS* for a particular environment. In our current implementation, the following erasure codes are included for testing: *replication* code, *distribution* code, *parity* code, *X* code, *B* code, *EVENODD* code and *GRS* code.

2 *HyFS* Architecture

HyFS is divided into four components: file system interface, file operation lib, erasure codes lib and network file system, which are described by Figure 1. To implement distributed storage, *HyFS* utilizes existing network file systems, like NFS. Because accessing network storage nodes may fail for many reasons, *HyFS* employs erasure codes to build cost-efficient redundancy solution. Files will be encoded before they are written and decoded before they are read. These operations are cooperated by two components: erasure codes lib and file operation lib. Erasure codes lib provides encoding and decoding function for erasure codes. File operation lib uses the erasure codes lib when accessing files, and it provides POSIX file API, such as $fread$, $fwrite$, and $fseek$, which enables *HyFS* to be portable to any Linux system. Lastly, the file system interface component implements a Linux file system.

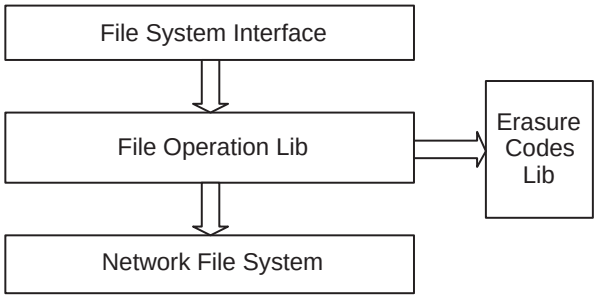

Figure 1. The Architecture of HyFS

3 Future Work

The basic functionality of *HyFS* has been implemented and the future works are: 1) measure the performance of *HyFS* by using real applications; 2) consider its scalability when deployed in a large network. The final goal of *HyFS* is to be a highly flexible and available distributed file system with high performance.

References

[1] Lihao Xu. Hydra: A platform for survivable and secure data storage systems. *Proc. of StorageSS 2005, Fair Fax, Virginia*, Nov. 2005.