Chapter VII

Replication Placement on Disks

Introduction

When extra storage space is available on the striping disks being described in the last chapter, the storage system may keep extra copies of the stored objects to enhance the performance of the storage system. If any one of the copy or the original copy is corrupted, the corrupted copy can possibly be recovered by comparison with its replicas. The replication strategy thus increases reliability of the storage system by applying redundancy on the stored objects.

Extra copies of objects may be created and stored on the storage system to increase the storage system performance. The presence of replicas on light loading disks may be able to reduce the period of time that an object is inaccessible. Thus, the replication strategy increases the availability of the stored objects.
The replication strategy can have several advantages. First, the replica on idle disks can increase the availability of data on corrupted and busy disks. Second, the replica on local server can reduce the network load to access objects from remote servers. Third, the replica on local server can also reduce the need to wait for the filling of initial buffer prior to consumption. Fourth, replica can avoid disk multitasking by avoiding the need to serve multiple streams from the same disk head.

We will describe the streaming redundant array of inexpensive disks (RAID) method that increases availability and fault tolerance in the next section. After that, we present the Lancaster storage server to reduce network load. Then, we show two data replication methods to reduce start-up latency. Afterwards, we explain how the data replication method can avoid disk multitasking. Before we conclude this chapter, we describe the replication method that balances the space and workload of storage devices.

**Replication to Increase Availability**

Redundant array of inexpensive disks has become widely accepted in recent years. Similar to RAID disks, the streaming RAID was proposed to serve multimedia streams. The objective of streaming RAID is to increase reliability and availability of multimedia data. The approach to achieve these objectives is by storing redundant information (Cohen & Burkhard, 1996; Tobagi, Pang, Baird, & Gang, 1993). Performance of multimedia streams is maintained by using multiple disks like the striping methods. A disadvantage of streaming RAID is that even more data are stored on the storage system.

Multimedia data are large, and each stream accesses data of an object for a long time. Thus, the disk containing the accessed object will become busy for a long period of time. When other streams try to access other objects residing on the same disk, the disk becomes too busy to serve them. As a result, new request streams will not be served until the disk becomes free. This disk outage problem limits the storage system’s ability to serve multimedia streams without degrading their quality.

Streaming RAID is an interdisk, strip-based method. In the streaming RAID method, every data object is divided into a number of blocks. Each block is a fixed number of bytes, and the data blocks are stored on multiple disks. One block from each disk forms a group. A parity bit is formed by XOR of one