Chapter XX

Space Efficient Pipelining

Introduction

Multimedia objects that are stored on tertiary storage devices enjoy the large storage capacity at low cost. These objects may be retrieved using staging, time slicing, or pipelining. The staging method retrieves the whole objects to the staging buffers prior to consumption at the cost of high start-up latency. The time slice method reduces the start-up latency at the cost of heavy switching overheads. The pipelining methods aim at minimizing the start-up latency when the tertiary storage bandwidth is not higher than the data consumption rate of the objects. Three pipelining methods are used to reduce the start-up latency and staging buffer size:

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1. Normal pipelining
2. Space efficient pipelining
3. Segmented pipelining

In the normal pipelining method, the sizes of the slices are minimized to maximize the overlapping between the displaying time and the retrieval time of the slices. In the space efficient pipelining (SEP) methods, the buffer size in accessing the slices is minimized. In the segmented pipelining method, the latency in serving interactive requests is reduced.

We have described the normal pipelining method in the previous chapter. The space efficient pipelining method is explained in this chapter. The segmented pipelining method is presented in the next chapter. In this chapter, the basic space efficient pipelining algorithm is first described in the next section. Next, the buffer replacement policies are explained before this chapter is summarized.

**The Basic Space Efficient Pipelining Algorithm**

The space efficient pipelining method has two objectives:

1. Reduce staging buffer size
2. Hide the start-up latency

The space efficient pipelining algorithm reduces the start-up latency by caching the beginning part of the objects on the secondary storage. It reduces the stage buffer size by re-cycling the disk space (Wang, Hua, & Young, 1996).

The space efficient pipelining method can be used in the following conditions:

1. Objects are stored on tapes or CD with low bandwidth.
2. Disk space is available to store temporary data.
3. Objects are retrieved for display purpose only.
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