

**Q 2.** In this problem you are to compare reading a file using a single-threaded server and a multi-threaded server. It takes 30 msec to get a request for work, dispatch it, and do the rest of the necessary processing, assuming that the data needed are in the block cache. If a disk operation is needed, as is the case half of the time, an additional 50 msec is required, during which time the thread sleeps. How many requests/sec can the server handle:

Total Time to Read file (from cache):

$$t_C = 30 \text{ msec}$$

Total Time to Read file (If file needed from Hard Disk):

$$t_D = 30 \text{ msec} + 50 \text{ msec} = 80 \text{ msec}$$

a) if it is single-threaded?

$$\begin{aligned} \text{Average Time to Read a File} &= \frac{1}{2} t_C + \frac{1}{2} t_D \\ &= \frac{1}{2} 30 \text{ msec} + \frac{1}{2} 80 \text{ msec} \\ &= 15 \text{ msec} + 40 \text{ msec} \\ &= 55 \text{ msec} \end{aligned}$$

$$\text{Total number of requests per sec} = \frac{1}{55 \text{ msec} \times 10^{-3}} = 18.18 \cong 18$$

b) if it is multi-threaded?

Average Time to Read a File:

$$\begin{aligned} &= \min(t_C, t_D) = (30 \text{ msec}, 80 \text{ msec}) \\ &= 30 \text{ msec} \end{aligned}$$

When thread goes in hard disk to get data it takes 50 msec. Now, at that the receiver thread would sleep. Until thread came with data in 50 msec. if it is thread that get data from cache or it is thread that get data from Disk, CPU will be busy.

$$\text{Total number of requests per sec} = \frac{1}{30 \text{ msec} \times 10^{-3}} = 33.33 \cong 33$$