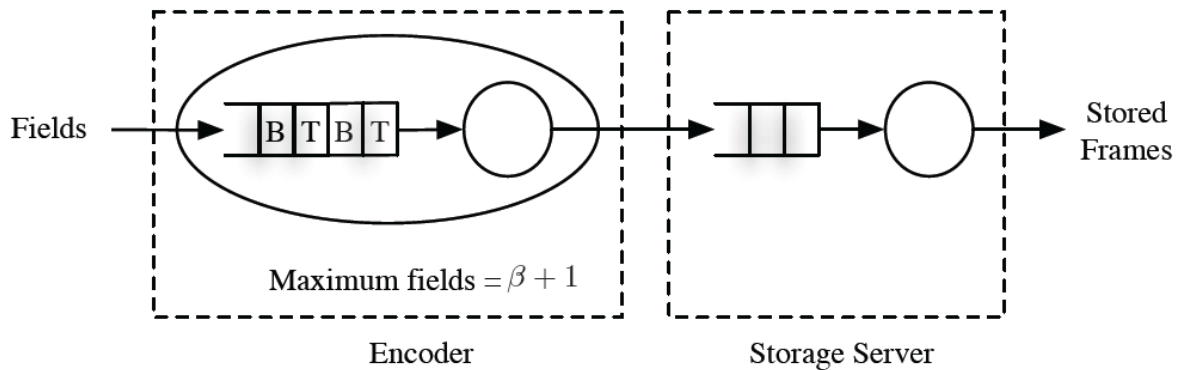


## Assignment 4

Due: Dec. 7<sup>th</sup> 2010

In this assignment you will construct a simulation of a video capture server and use this simulation to undertake performance analysis. The system can be modeled as tandem queue with two stages:



The system operation is as follows:

- Video enters the system in the form of fields. Each field is either a *top* field or a *bottom* field; the first field received will be a top field. A top field and the bottom field immediately following it make up a *frame* of video. Each frame of video is therefore comprised of two fields: a top field and a bottom field.
- Arriving fields are placed into a buffer prior to encoding. This buffer has the capacity to hold  $\beta$  fields. If either of the two fields of a frame is lost, the remaining field is useless. For this reason, the following actions are taken if an arriving field finds the buffer full:
  - If the arriving field is a top field, it is discarded. The following bottom field will also be discarded whether or not upon its arrival there is space for it in the buffer.
  - If the arriving field is a bottom field, it is discarded. The field that was last placed in the buffer, which will be a top field, is removed from the buffer and discarded.
- Each field requires processing by an encoder. The time required for this encoding depends on the complexity of the field, measured in fobs, and on the capacity of the encoder, expressed in fobs per second. Let the capacity of the encoder be  $C_{enc}$ .
- Once encoded, the pairs of fields that make up video frames are processed together by the storage server as follows. When a top field is ready for processing by the storage server, it will remain in the queue—and the storage server will remain idle—until its corresponding bottom field also arrives. At that time, both fields will be removed from the queue and storage of the video frame will commence. The amount of time required to store the frame depends on its size in bytes and on the capacity of the storage server in bytes per second. If the complexities of the fields making up the frame are  $h_1$  and  $h_2$  then the frame's size in bytes will be  $\alpha(h_1 + h_2)$ . Let the capacity of the storage server be

$C_{storage}$ . Furthermore, assume that there is always sufficient buffer space at the storage service facility to store an arriving field.

Suppose that we wish to study the capacity of encoder required to ensure that all frames are processed by the storage server. This means that no frames are lost because of lack of space in the encoder buffer and that the storage service facility is stable. Furthermore, we want to measure the utilization of the storage server.

Write a simulation program (In C, C++, Java, or any other you like) for this model. You are required to provide in-line documentation and proper indentation, clearly identifying the steps in the initialization routine, each event routine, and the report generator. Note:

- Your program must compile and run correctly. Provide a README file to describe how to compile and run your program
- Provide a Makefile to compile your source code and generate the executable.
- Submit your program, along with the README file and the Makefile, electronically to the instructor. Never submit any printed copy for this assignment.
- In constructing your simulation, you may assume the following about the operation of the system:
  - The time between field arrivals is deterministic and equal to  $\tau$ .
  - The complexity of a field follows an exponential distribution with parameter  $h$ .