

OPERATING SYSTEMS

INPUT/OUTPUT- 2

4. BUFFERING

Often a user process generates requests for output (say) much faster than the device can handle. Instead of having a process waiting for 'request-serviced', introduce a buffer to store all requests, then *process* can go onto do other things. This is buffering.

Similarly for input, a buffer can be filled from a device; a user process takes its input from buffer; it is forced to wait only when the buffer becomes empty. When this occurs the operating system refills the buffer and the process continues.

Double buffering: is the case when two buffers are used. In a producer/consumer situation, mutual exclusion prevents both processes accessing the buffer at the same time thus, possibly, causing delays. Giving each process its own buffer will reduce the probability of this delay;- transfers between buffers takes place when neither is being accessed by its process.

Note: buffering smoothes out the peaks

5. FILE DEVICES

How do we deal with files stored in I/O devices?

- Only some I/O devices can support files (i.e. read/write on particular area of the medium, e.g. disc, magnetic tape, but not printer, keyboard, vdu), these devices are called file devices.**
- File: a data area of an arbitrary size which can exist on a medium controlled by the device.**
- A file has a unique name which is used by the op sys to find the location of the file on the appropriate medium, . . . in a directory of files**
- Directing a data stream to/from a file device: associate a stream with a file name, not device name; typical job description:**

Input1 = 'testdata'

i.e. stream 1 data is to come from file 'testdata'

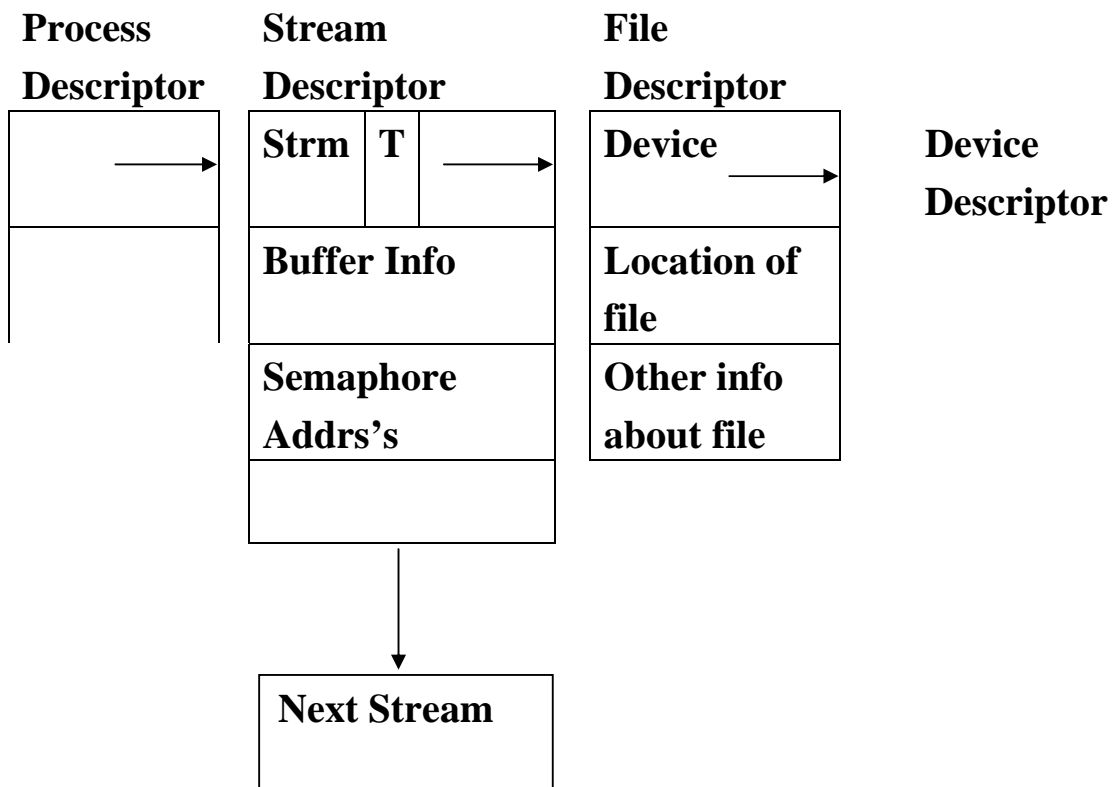
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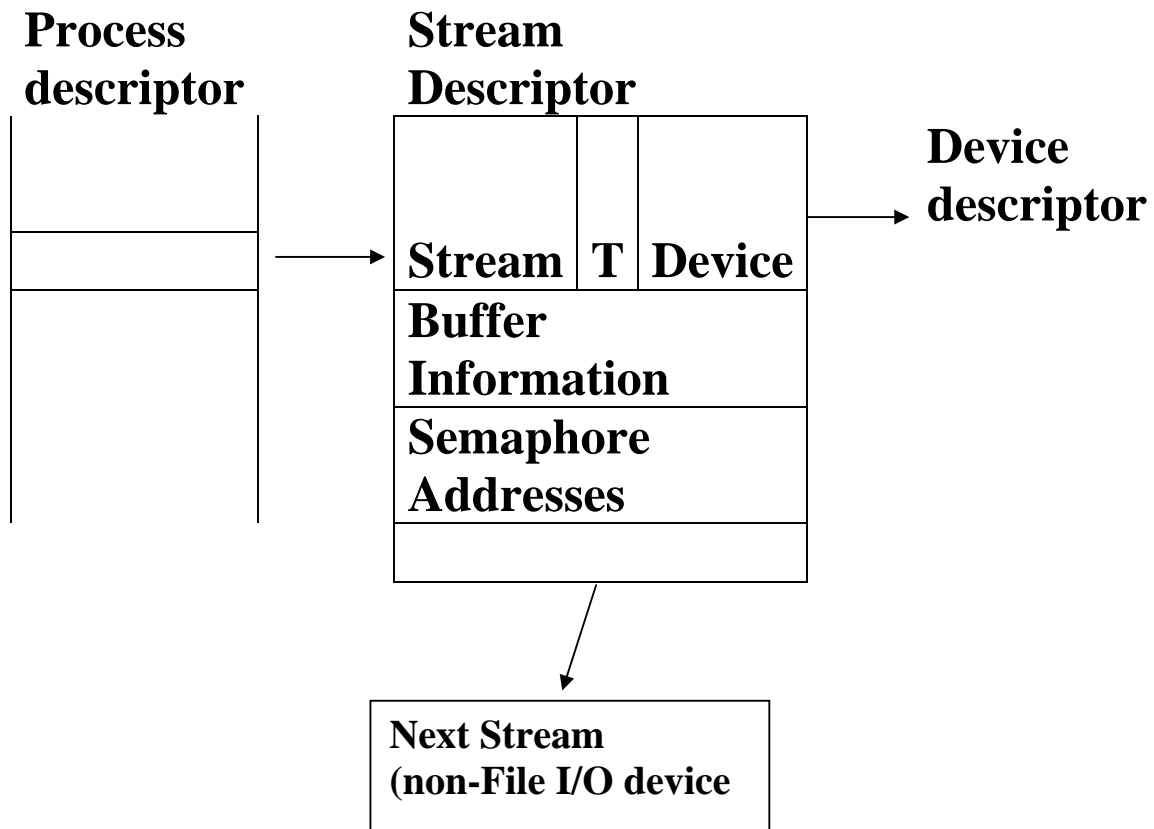
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Opening a File

- Stream is opened, op sys looks up file name in directory to get device number & file location.
- A file descriptor is created to hold info for subsequent accesses to the file to include:
 - Address of device descriptor
 - Location of file on that device
 - Whether read/write
 - File internal organization
- A pointer to the file descriptor is put in stream descriptor.

- File descriptor is not needed for non-file devices, e.g. keyboard.



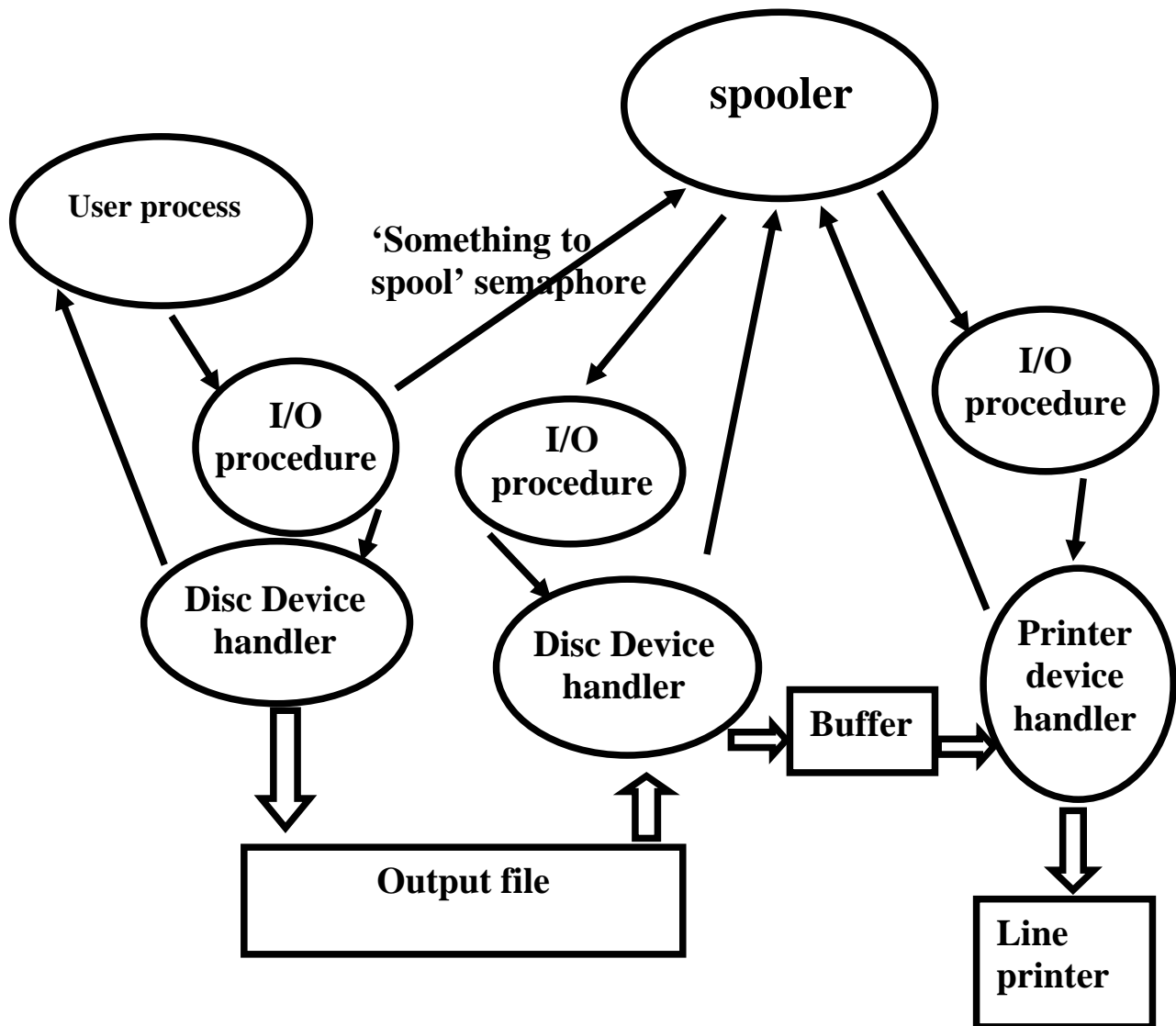
Stream Information for Non-File Devices
 (t = device type)

6. SPOOLING

Spooling is a higher level buffering to even out demand for unshareable resources: e.g. printers.

- ▽ **During periods of high demand several processes are held up waiting for use of scarce resources.**
- ▽ **During other periods these same devices may be lying unused.**
- ▽ **Spool all I/O to these devices, i.e. instead of I/O directly to device, do it on intermediate medium, disc.**
- ▽ **'Spooler' then moves data between disc and device.**
- ▽ **Line printer example: A process wanting to use printer is given disc file to store all its output, i.e. file is virtual line printer. When stream is closed, file is added to queue. Spooler takes files from queue & sends them to printer.**

```
repeat indefinitely  
  
begin   wait(something to spool);  
        pick file from queue;  
        open file;  
        repeat until end of file;  
        begin   DOIO (parameters for disc read);  
                wait (disc request serviced);  
                DOIO(parameters for line printer  
                output);  
                wait (printer request serviced);  
        end  
end;
```



-  Indicates Data transfer
-  Indicates process communication via semaphores

Notes

- 1. A buffer is used between disc & printer.**
- 2. Semaphore ‘something to spool’ is signalled (incremented) by any process which closes a line printer stream, i.e. completes a file for output.**
- 3. Output is often dealt with in favour of short files first.**

Advantages of spooling

- 1. Evens out pressure on heavily used devices.**
- 2. Reduces possibility of deadlock caused by injudicious peripheral allocation.**
- 3. Easier to produce several copies without re-running jobs.**

Disadvantages

- 1. Need large amount of disc space.**
- 2. Heavy traffic on the disc channel.**
- 3. Not feasible for real-time I/O.**

Summary

Separating I/O into user process, I/O process and device handler makes it easier to achieve the 3 objectives:

- character code independence**
- Device independence**
- Uniformity of device treatment**

However,

Because of their general nature, these routines can sometimes be slower to execute than special pieces of code tailor-made for specific I/O operations and devices. Careful attention must therefore be paid to optimizing the efficiency of these routines. Sometimes, for the sake of efficiency, I/O procedures & device handlers are put together and optimized for specific applications of known operations & devices.

BSC COMPUTER STUDIES (PT) YEAR 2, OPERATING SYSTEMS,
QUESTIONS

INPUT/OUTPUT – 2

1. Explain the term Buffering and discuss its uses in operating systems. How does the op sys handle buffers?
2. How do I/O procedures cope with buffered applications?
3. What does the term File Device mean? Give examples of both file and non-file devices and explain how a Job Description command can be used to associate a stream with a file name. Use a diagram to illustrate your ideas.
4. With the aid of a diagram describe how a file is opened listing the type of information you expect to find in a file descriptor. Compare this operating with that for non-file devices.
5. Define the term Spooling and compare it with Buffering. What is the use of Spooling?
6. With the aid of a diagram and pseudo code program describe how a file is printed out, distinguishing clearly between data movement and control flow under semaphore direction.
7. List the advantages and disadvantages of spooling and discuss two in detail.
8. Do the routines for I/O explained so far lead to efficient operation? Discuss.