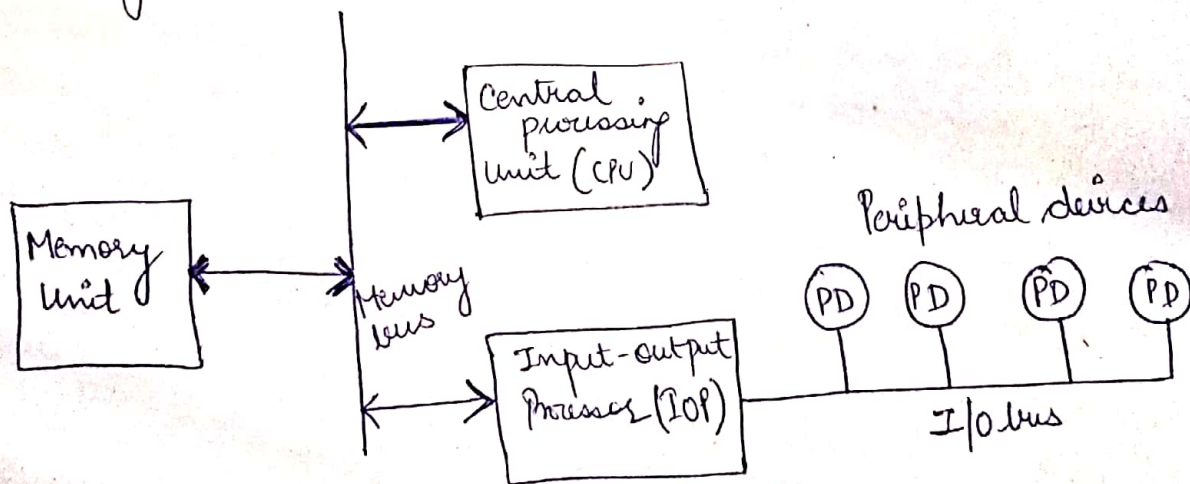


INPUT-OUTPUT PROCESSOR (IOP)

(19)

An input-output processor (IOP) may be classified as a processor with direct memory access capability that communicate with I/O devices. Each IOP take cares of input and output task, relieving the CPU from the housekeeping chores involved in I/O transfer. A processor that communicates with remote terminals over telephone and other communication media in a serial fashion is called a data communication processor (DCF).

The IOP is similar to a CPU except it is designed to handle the details of I/O processing. The IOP can fetch and execute its own instructions. IOP instructions are specially designed to facilitate I/O transfer. In addition, the IOP can perform other processing task, such as arithmetic, logic, branching.



(BLOCK DIAGRAM OF COMPUTER WITH I/O PROCESSOR)

The memory unit occupies a central position and can communicate with each processor by means of direct memory access. The CPU is responsible for processing data needed in the solution of computational tasks. The IOP provides a path for transfer of data b/w various peripheral devices and the program. From then on the IOP operates independent of the CPU and continues to transfer data from external devices to memory.

The data formats of peripheral devices differ from memory & CPU data formats. The IOP must structure data words from many different sources. For example, it may be necessary to take four byte from an input device and pack them into one 32 bit word before the transfer to memory. Data are gathered in the IOP at the device rate and bit capacity while CPU is executing its own program. After the input data are assembled into a memory word, they are transferred from IOP directly into memory by "stealing" one memory cycle from the CPU. Similarly an output word transferred from memory to the IOP is directed from the IOP to the output device at the device rate & bit capacity.

In most computer system, the CPU is the master while the IOP is a slave processor. The CPU is assigned the task of initiating of all operations, but I/O instructions are executed in the IOP. CPU instructions provide operations to start an I/O transfer and also to test I/O status conditions needed for making decisions on various I/O activities. The IOP typically ask for CPU attention by means of an interrupt. It also responds to a CPU request by placing a status word in a prescribed location in memory. When I/O operation is desired the CPU informs the IOP where to find I/O program & then leaves the transfer details to the IOP.

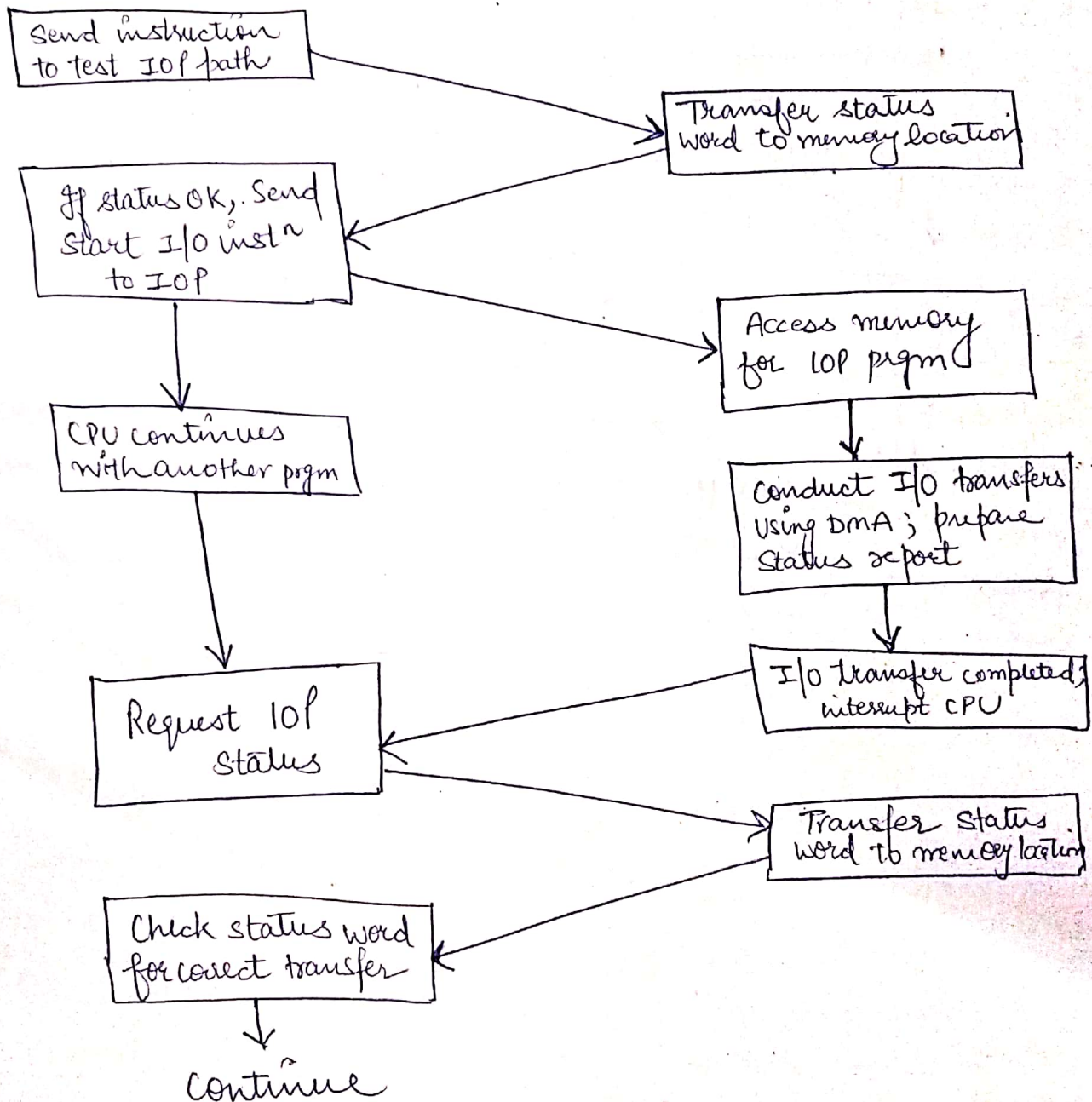
Instructions that are read from memory by an IOP are sometimes called COMMANDS, to distinguish them from instructions that are read by the CPU. Otherwise, an instruction and command have similar functions. Commands are prepared by experienced programmers and are stored in memory. The command words constitute the program for the IOP. The CPU informs the IOP where to find the commands in memory when it is time to execute the I/O program.

CPU-IOP COMMUNICATION

The communication b/w the CPU and IOP may take different forms. In most cases memory unit acts as a message center where each processor leaves information for the others. (20)

CPU operation

IOP operation



[Example by which CPU & IOP communicate]

The CPU sends an instruction to test the IOP path. The IOP responds by inserting a status word in memory for the CPU to check. The bits of the status word indicate the condition of the IOP and I/O device such as device ready for I/O transfer.

The CPU refers to the status word in memory to decide what to do next. If all is in order, the CPU sends the instruction to start I/O transfer. The memory address received with this instruction tells the IOP where to find the program.

The CPU now continues with another program while the IOP is busy with the I/O program. Both programs refer to the memory by means of DMA transfer. When the IOP terminates the execution of its program, it sends an interrupt request to the CPU. The CPU responds to the interrupt by issuing an instruction to read the status from the IOP. The IOP responds by placing the content of its status report into specified memory location. The status word indicates whether the transfer has been completed or if any errors occurred during the transfer. From inspection of the bits in the status word, the CPU determines if the I/O operation was completed without errors.