

IMPLICATIONS OF MANAGEMENT

For **configuration**, we want a flexible system, designed to adapt easily – preferably without stopping the system – to changes in hardware and software. Starting and stopping are special cases, which on large systems must be managed with great care, and good software to guide these operations can be of great value.

For **planning**, we want information, so software which can keep sensible records of performance is valuable. This is important in all aspects of the system's performance, but is particularly useful in managing devices, for that is where the effective performance of the system as a whole becomes evident. The primary need here is for usage and performance statistics, which managers can use to decide on policy when extending or replacing the computer system. The only place where this can sensibly be gathered in any systematic way is at the system-device interface, which is – in terms of our description – in **doio**.

Usage : An appropriate measure, or some appropriate measures, of how much the device is used. Just what is appropriate depends on the device. For a simple independent device such as a printer it might be sufficient to count the number of characters or lines printed, or the length of time during which the printer was in use. A device used for direct input or output by people is unlikely to be used to the limit of its capacity, as people are fairly slow, so it might be better described by some measure of session lengths. For a storage device such as a disc drive, we might also be interested in the amount of material held.

As well as the total usage over a period, it is commonly useful to know something about the distribution, perhaps hour by hour over a week. This can help to identify peak times, and (as we shall see later) to schedule work to take best advantage of the system's facilities.

Performance : As well as the sheer amount of work done, measured by the usage parameters, we want to know how well it is done. The usage distribution is a step in this direction, but it might also be helpful to record performance figures directly. Here we are most interested in the rates of data transfer, which tell us something about the data path capacities which we need, and also figures which measure delays, such as waiting times or queue lengths, which identify inadequacies in the system.

For **smooth running**, we want good scheduling software at all levels. Manual operations should be assisted where possible, automatic operations should be executed as quickly as possible consistent with the safety and integrity of the system. It is important that the whole system should be well integrated, so that all its components complement each other without interference.

And this is really the end, but we've kept one chapter back for a tailpiece. Our reason has more to do with æsthetics than with our global plan for the treatment; the first paragraph of the chapter explains.
