# Software Engineering for Embedded Systems: Chapter 23. Programming for I/O and Storage

*Xin-Xin Yang*

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Input and output (I/O) devices are very important components in embedded systems. I/O diversity makes I/O management in embedded systems a very complicated process. One of the basic functions of an embedded operating system is to control and manage all of the I/O devices, and to coordinate multiple processes accessing I/O devices simultaneously. The key function for device management is to control I/O implementation between the CPU and the devices. The operating system must send commands to the devices, respond to interrupts and handle exceptions from the devices. It should also provide a simple and easy-to-use interface between the devices and other parts of the system. The I/O management module needs to improve parallel processing capabilities between the CPU and I/O devices as well between I/O devices. To get the best utilization efficiency of the system resources, I/O management modules should provide a unified, transparent, independent and scalable I/O interface. Storage in this book refers to external storage devices such as NOR/NAND flash, eSDHC, U-Disk, HDD and SSD, which are commonly used in embedded systems. With the recent development of cloud computing, storage technology plays an increasingly important role in systems. This chapter will discuss data transfer modes between CPU and I/O devices, interrupt technology, I/O control processes and the corresponding device driver implementation process. The programming model of storage devices is also discussed, including feature support and performance optimization.

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