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An Introduction to Multiple Microprocessor Systems

The computational power of any given microprocessor is fixed. It is fixed at the time of its conception by the engineers who design its architecture, and by the technology with which the chip is fabricated. A microprocessor user wishing to increase the throughput of his system, or to reduce its response time, cannot add extra instructions or addressing modes to the microprocessor's repertoire. He can, of course, buy a new microprocessor (i.e. a different processor or the same processor fabricated with newer technology permitting a higher clock rate and lower cycle time) which has the power he requires. This course of action may lead to high software costs if an entirely different processor is adopted, or to a system redesign if a faster version of the existing processor is selected. An alternative way of increasing the system's throughput is to emulate the existing microprocessor with bit-slice components. By emulating a microprocessor with high-speed bipolar bit-slice elements it is possible to add new instructions and addressing modes and to speed up the internal operations of the (emulated) microprocessor without incurring large overheads necessitated by either changing all the software or heavily modifying the system's hardware. Bit-slice systems will not be considered further in this book, although bit-slice architectures should not be overlooked by the designer.

Another way of increasing the throughput of a microprocessor system is to employ more than one microprocessor, so that several computations can take place simultaneously. The greatest advantage of a multiple microprocessor system is that a considerable increase in computational power can be attained for a relatively modest increase in the cost of the system over a single processor arrangement. It is the ratio of the cost of the microprocessor to that of the rest of the system (mainly memory) which makes the multiple microprocessor system so attractive. Typically, the cost of the microprocessor is \$3 – 20 which is negligible when compared with the cost of 32K bytes of static RAM—\$300 – 600.

The economic advantages of a multiple microprocessor system stem from the sharing of common resources between several microprocessors. The actual advantages accruing to any given multiple microprocessor system depend very much on the precise arrangement of the system. Unfortunately, when more than one