

Hardware

The word "hardware" refers to all physical parts of a computer, as opposed to the "immaterial" components, i.e. software. According to the Merriam Webster dictionary the word "software" was first used in the 1960s, but the word hardware has been used since the beginning of the computer era. Both terms "hardware" and "software" have been almost universally adopted in other languages. One notable exception is French. The French Academy has taken care of finding translations for computer related terms so that software is called "logiciel" (the logical part) and hardware "materiel" (the material part). Software engineering is called "genie logiciel".

So-called reconfigurable hardware is a modern technique used to build computer chips that bridge the gap between hardware and software. The logical architecture of these devices can be changed on demand. A new chip layout can be downloaded so that the chip computes some especial function more efficiently. This means that the hardware adapts to the computation at hand and part of the software is cast into hardware. Reconfiguration time is the main issue but some devices have reduced it to less than one microsecond. Curiously, the ENIAC, the first large-scale electronic computer of the world, had to be rewired for every computation. It had no software – the computation was embodied in the actual wiring layout of the machine. The computer industry has thus come full circle now that reconfiguring hardware is not a matter of days, like for ENIAC, but of fractions of a microsecond.

Programmable gate arrays (PGAs) are circuits used to implement reconfigurable hardware. As the name indicates, a PGA consists of an array or matrix of logic gates which can be connected so as to produce any desired logical function. Field programmable gate arrays (FPGAs) can be programmed many times, even when the computer is running, which is called dynamic reconfiguration or also on-the-fly reconfiguration. The world leader in the FPGA market is the company Xilinx whose Virtex family of FPGA devices offers now up to 3.2 million logic gates on a chip. Xilinx was founded in 1984 and is headquartered in San Jose, California.

In the future, embedded processors will be available in many "information appliances" present in all households. These appliances will be connected in networks and will communicate with each other. One way of periodically transforming them is by using reconfigurable hardware, which can be updated from the network. Some researchers even dream of hardware that could evolve automatically, learn from past errors, and become better every day.

References

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