To complete a VLSI design today, many different types of computer tools are needed. These include simulators of various levels, timing analyzers, a schematics and layout editor, a design rule checker, a layout extractor and verifier, a test vector generator, a fault simulator, module generators for RAM, ROM and PLA, and automatic placement and routing tools. In addition, a data-base management system is required to handle all of the design data needed and generated by these tools. Many of these tools are developed by internal computer aided design (CAD) development groups within different companies. They are available either on large mainframe computers or super-minicomputers because of the need for powerful hardware and efficient operating system support.

Due to the rapid advances in microprocessor technology, workstations, which are stand-alone microprocessor-based computer systems with high speed graphics, are being offered by many vendors. Many of these workstations have multiple processors and hardware graphics accelerators. The performance of these high-end workstations approaches the performance of some of the 32-bit minicomputers. By tightly coupling the graphics processor to the graphics device, the interactive graphics on these workstations exceed the graphics capabilities available on many minicomputer systems. Yet, most of these systems were based on microprocessors introduced several years ago. With the newer and much higher performance microprocessors introduced recently, more powerful workstation hardware will soon be available economically. This trend will allow each engineer to have a workstation, and each workstation will have the equivalent computing power of a super-minicomputer.

As workstation hardware progressed, a powerful operating system was needed to fully utilize the capability. The UNIX operating system has been chosen by many vendors due to its availability, portability, flexibility and functionality. It is quickly becoming the standard operating system for workstations. This development provides the users with a common environment for different hardware acquired from different vendors. This also helps software developers by allowing them to easily port their software to different systems without major changes due to the differences in different operating systems.

Several newly formed CAE/CAD companies are taking advantage of this progress and are developing engineering workstations for CAE/CAD applications. Most of the tools needed for VLSI design are either available now or are in active development in these companies. The currently available systems are primarily for CAE applications such as schematic entry and capture, timing verification and analysis, and logic simulation. The more recently introduced workstations provide physical design capabilities such as full custom layout, on-line design rule checking, circuit simulation, module generation, and limited place and route capabilities. Many of these companies are offering turn-key systems that are UNIX-based and can be ported quickly to the newest UNIX-based hardware available. SDA Systems is providing both the CAE and physical design tools in an integrated environment that allows all SDA tools, which also use a unified database for all the design information, to communicate with each other effectively.

Networking provides a way for the workstations to access different dedicated resources that are more efficient for certain tasks. These resources include hardware simulation accelerators, mass storage devices, plotting servers, printers, and some CPU intensive programs available only on mainframe computers. Standard networking protocol such as TCP/IP allows hardware from different vendors to communicate electronically.

Interchange formats such as EDIF are being developed and accepted by many CAE/CAD vendors. This will allow design data to be transferred between systems from different vendors.

In summary, workstation hardware is rapidly improving due to the advances in microprocessor technology. The standardization of the operating system allows application programs to be quickly ported to the latest hardware and benefit from the performance improvements. Standard interchange formats and networking protocols allow design data to be transferred between systems. Although the workstations available today cannot satisfy all the needs of the VLSI designers, the functionality and efficiency of implementation of many tools will certainly improve their productivity. Since both the hardware and software for workstations are progressing rapidly due to the intensive efforts of all the vendors, engineering workstations will certainly be a good working environment for the VLSI designers.

**References:**

1. UNIX is a Trademark of AT&T Bell Laboratories.

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