Rapid Turn-Around Design Style and Technology: Impact on Computer Architecture

Vojin G. Oklobdzija[1]
Electrical Engineering and
Computer Science Department
University of California
Berkeley, CA 94720

(415) 643-6764

The VLSI evolution has reached a new dimension: not only can we integrate one million transistors on a single chip of silicon, but also a very short turn-around cycle is possible due to the new advances in the integration and fabrication process, and supporting CAD tools.

There are two consequences of this development:

a. By default, the complexity of a chip has forced technology houses to move from the component to the system domain.

b. Shorter fabrication time has created fierce competition, because the availability of the new technology always makes higher performance possible and threatens the existing products with obsolence.

The life span of the existing product becomes shorter while the demand on the performance of the new one becomes greater.

How does this development impact the way we design, plan, and architect future products?

The time element created by the rapid turn-around development in VLSI technology has brought a new quality into the picture. New possibilities are created, and new approaches are yet to evolve.

The increase in chip complexity has imposed additional requirements on design tools and on the systems on which those tools are installed. Managing complexity needs not only larger and faster platform, but intelligent managing of hierarchy, sharing of data, and user interfaces.

Shortening of the design cycle has created an additional demand especially on design hierarchy and interfaces between many different levels.

For many relatively small design foundries, moving into the system design meant an incremental growth for the existing CAD system. For them, a large mainframe computer was not afordable and would not likely be in the future. They were forced to make an intelligent use of their existing work stations and manage complex designs by utilizing a large number of existing work stations through distributed data bases and networking. Consequently, sophisticated solutions were developed making the necessity of the mainframes questionable.

On the other hand, the pressure from the rapid pace of technological changes and development has demanded that the design cycle be considerably shorter.

It is estimated that the technology cycle today could be as short as one and a half years, and that design and development cycle should not be longer.

How does this impact design and development cycle?

At the technology level, prefabrication (as a way of shortening fabrication cycle) proliferated, resulting in technologies such as gate arrays, sea of gates, and ASIC.

In the logic and circuit domain, the use of standard cells and predesigned components contained in the libraries shortened logic design by enabling selection and elevating design to a higher level.

The most recent development in the system area has been the emergence of RISC architectures, such as SPARC and MIPS, which are establishing themselves as a standard, and their adoption by the ASIC manufacturers.

It is likely that managing complexity in a distributed system environment, hierarchy, and standard interface between diferent levels will be the issues in CAD.

In the architecture, simplicity such as RISC might prevail, enabling shorter design cycle.

However, the questions raised have yet to be answered.

[1]On leave from IBM T.J. Watson Research Center, Yorktown Heights, NY