

Hardware Goes Soft! Or is it Software Goes Hard? The Emerging IP Business.

For the most part, hardware and software development and design have been considered different disciplines. There have been a few exceptions along the way - transputers and occam saw software people plugging systems together and hardware engineers writing more of the software, but these were the exception rather than the rule.

Hardware is increasingly specified in some form of system description language. There are even tools now for creating visual representations of this. And for the adventurous, there are systems where you write your system in a C like language and tools split it into two parts - one is compiled through a traditional compiler and becomes the code that runs on a processor; the second is compiled into a description to be programmed into an FPGA. Depending on system design and requirements, the processor can even change the FPGA functionality while the system is running. An example of a use for this is to load the same silicon with different algorithms in an image processing subsystem. Self modifying hardware! Design cycle times can be cut to minutes, and the same quality of design that takes 6 months by traditional means can be done in a week or two. This is just one example of some of the work that has been developed in OMI and is now commercially available.

Developments such as these, improved synthesis tools, high level libraries and many others are driving the emerging industry in re-usable IP, currently estimated at \$300M and expected to exceed \$1billion by the year 2000. This is the opportunity that led to OMI - the "system on a chip" vision.

HOWEVER, NOT ALL IP IS EQUAL!

Ease of use varies. IP has recently been classified into three categories by the VSI Alliance, namely "soft", "firm" and "hard".

"Soft" IP comes in terms of a VHDL, Verilog or similar description. This gives the greatest flexibility, but will require the most effort to turn it into silicon. Things such as maximum clock speeds, performance, silicon area, power dissipation, will not be known until the designer has gone most of the way through the process of the design. Soft IP can also be targeted to FPGAs and ASICs, as well as custom silicon.

At the other end of the scale, "hard" IP has already

been routed and characterised, but only for a specific process. Thus, it is much more ready for use, if, and only if, you have access to that particular process.

"Firm" falls in between the two - there are some constraints, and rough characteristics might be known.

However you look at it, our "hardware" increasingly is really a programme describing how the silicon will behave. When the protection and payment issues have been resolved, the lower value IP will start to be available over the Internet for trial and purchase, cutting another few days off the design cycle time. Very valuable IP will still continue to be traded on an individual basis, and the most valuable IP will not be traded at all. This leads to another conclusion - IP loses value over time. Next year, a design is expected to have more features or functionality for the same price, which means that this year's design will only be worth half the price.

Now all we need is a manufacturer to give us a standard microcomputer core with some widely used interfaces and an area of FPGA and supporting tools, for a few dollars, and anyone will be able to make their own custom devices, downloading functions from Internet sites. With the continuing increase in the density of silicon, it is not an unreasonable prospect. This must be close to the ultimate in reusability and design productivity.

Except that for the manufacturers to do it, someone needs to place an order for a million or more, because without a large market for a standard part, it is not worth their while to make it. And custom silicon will always be more efficient than FPGA for the same area. So if anyone has a high volume product plan that needs a part like this, let me know, because I can find hundreds of engineers who want the same thing, but don't want the other 999,000 or so !

