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Enabling Electronic Design

In-house EDA Software development - the way ahead?

There is increasing consumer demand for semiconductors with more functionality, lower cost and shorter time to market. Small feature sizes are enabling exponential increases in the transistor counts. While the manufacturing technology is there to support higher transistor count chips, the design technology has fallen behind. The number of available transistors is growing faster than the ability to meaningfully design them within the cost and time constraints as desired by the market. This is being commonly referred to as the "design productivity gap".

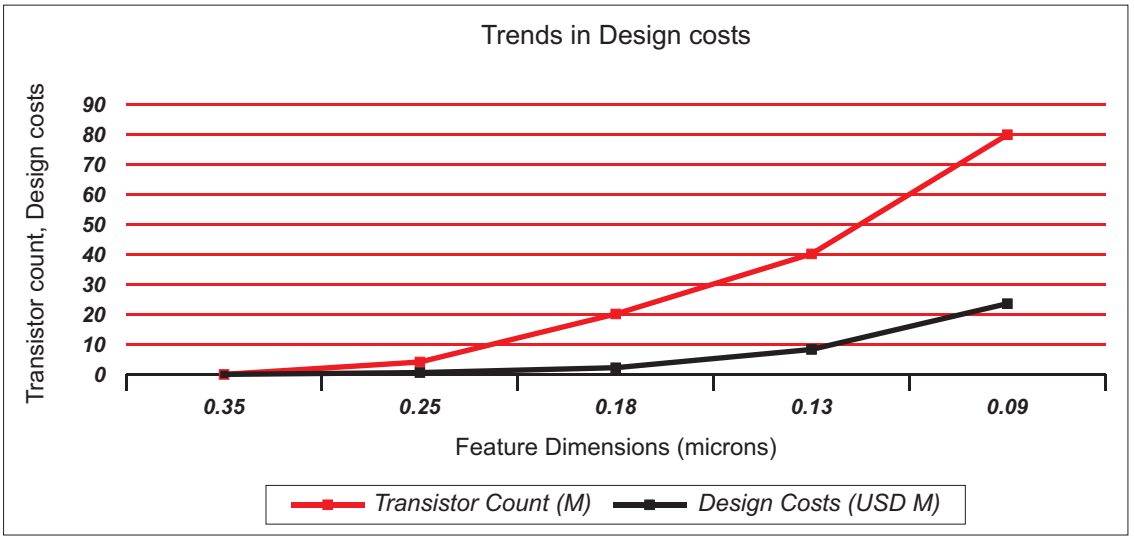
There have been various studies in the recent past which have tried to analyze the causes and the potential solutions that can bridge this gap. The report developed after one such study, The International Technology Roadmap for Semiconductors (ITRS) 2001 report, cites system complexity [design of complex functionality and its verification] and silicon complexity [Impact of physical effects on design implementation] as two significant causes for this gap.

There are two ways in which this design productivity gap can be bridged:

1. Outsourcing part of design to design services companies that bring additional capability and capacity to the table.
2. By creation of new design methodologies that enable re-use and decrease the uncertainties associated with the design and verification process. The new paradigms of design methodology include:

- Exploiting maximum reuse of already designed components
- Avoid iteration between the various design stages. Thus, are able cater to multiple constraints and optimize together.
- Support higher level abstraction of function, performance and manufacturability.

It can be argued that even with the first option, the problem is just thrown over the wall to another organization. The designer there would probably face the same problems. Hence, we believe the second option is perhaps the best way to decrease the design productivity gap. These new methodologies can become a reality only if they are supported by newer design tools.
It might be the case that only those semiconductor design companies that are able to invent automate or at the least keep pace with these new design methodologies will succeed. The focus on design methodology supported adequately by tools has a competitive dimension to it as well: As the recent study sponsored by the EDA Consortium indicates, those semiconductor companies that put a higher importance to design capabilities and spent a greater percentage of their revenues on EDA expenditure (including licensed tools, in-house tools and design flow development costs) indeed have achieved market leadership.



The above analysis holds equally true for a design services company as only those services companies that provide the maximum design productivity advantage will be the leaders.

EDA currently is one of the most important components of any R&D effort in the semiconductor design company. However, with its increasing importance, it could well be a core strategic asset in the future. As a recent article in the Harvard Business Review [Breakthrough Ideas for 2004: The Law of Conservation of Attractive Profits, February 2004 issue] suggests, "that the location in the value chain where attractive profits can be earned shifts in a predictable way over time and that companies that outsource activities that are not today's core competencies *[but might be tomorrow's]* may well miss the boat". Thus in-house development of EDA capabilities should be an agenda for any EDA group in a company. This fact is recognized by many leading large semiconductor companies in the world. According to a report on the size of the EDA market in 2002, commercially licensed EDA tools only had a 30% share of the total EDA spend indicating that a significant chunk of EDA tools are developed in-house in a design company, perhaps customized to a specific in-house design methodology or developed because their functionality was simply not available in commercially available tools.

While the commercially available EDA tools are getting enhanced to handle the design complexity challenges, a semiconductor design company needs to devote more attention to developing **in-house EDA capabilities** for reasons in addition to the above:

1. Need to decrease EDA tool ownership costs - There are also studies that point to an increasing cost of design and its implementation. A study sponsored by the EDA Consortium indicates that with decreasing feature size, the design costs are increasing at an almost exponential rate, if the designer needs to take full advantage of the increased transistor count available.

The annual total cost of ownership of off-the-shelf EDA tools is a combination of the following

a. (Subscription license) * Number of seats
b. (Annual Maintenance) * Number of seats
c. Cost of Internal EDA resources

Compared to the above, in case the semiconductor company decides to own and develop the EDA tool internally, the total cost of ownership of in-house tool will be combination of the following:

a. Cost of in-house development
b. Cost of annual maintenance

Evidently, the Total cost of ownership of in-house EDA tool is independent of the number of designers and thus will provide EDA tool cost savings as the design teams grow. However, the key decision variable here would be the number of licenses required by a design team: there needs to be a minimum number to tip the scale in favor of in-house development.

2. Need for platform or application specific tools - As explained in the ITRS 2001, in many of the growing semiconductor markets, the demand is there for low cost, relatively low performance but fast time to market designs. Addressing these markets will require tools that help integrate already developed digital and analog components on a System on Chip. In order to quickly explore, various system design options, tools that abstract the functional, performance and manufacturability of various components to high level and help minimize the total system costs will be needed.

It is most likely that EDA budgets as a proportion of design costs will increase in the future as complexity scales. However, it might be prudent to reflect on the percentage of this additional spend that goes into strengthening in-house EDA capabilities which could enable a higher return on the overall investment on the EDA infrastructure. This would entail a semiconductor design company to either strengthen its in-house EDA team or work very closely with EDA companies who are willing to work in this services mode.