

CELL CHARACTERIZATION

Customer Overview

Our customer in this case is a telecom giant headquartered in North America providing networking and telephony solutions to clients worldwide. The company supplies solutions and services that support voice, data and video transmission over wireless and wire-line technologies. With multi-billion US dollar annual revenues, the company is vertically integrated and operates globally.

Objective

Being an integrated device manufacturer, the company's IC design team used proprietary standard cell libraries that were tuned for in house requirements. While this meant greater customization and thus better performance for the specific functional requirements, it also entailed a regular upgrade and maintenance effort in the form of characterization. Whenever new cells or libraries were developed or the technology or process parameters changed, the standard cells needed to be characterized again.

Characterizing a library would require a number of steps such as:

- Generation of the Spice model for each of the library elements.
- Generation of the HDL (Verilog/VHDL) models.
- Extraction of the timing/delay parameters and other parameters such as power dissipation etc.
- Documentation of the above information into a databook for usage by the designers. The client often found the above as a time-consuming, tedious and highly error-prone process.

The client studied a number of automatic cell characterization tools and found out that almost all of

them were too generic in nature and not amenable to the specific requirements. Typically, library designers tend to characterize the libraries using their own unique methods for several parameters such as Set up/Hold time, Input Capacitance, Power dissipation of complex gates etc. Understandably, the generic cell characterization tools do not meet these requirements. As a result, the client decided to develop its own cell characterization tool which would meet its specific requirements.

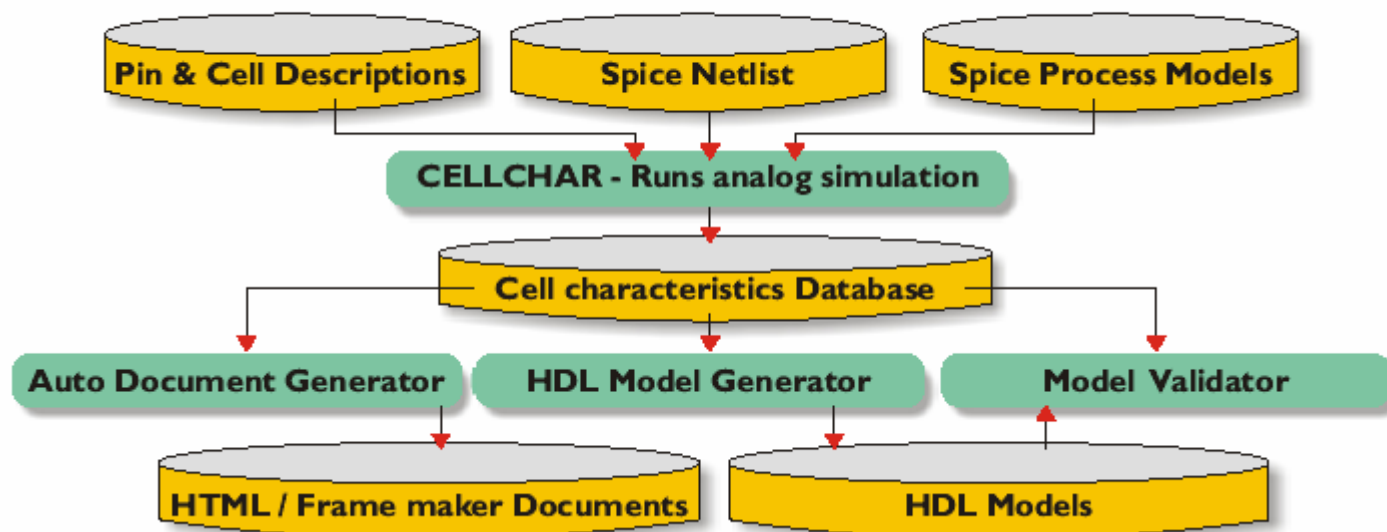
The challenge for our delivery team was to develop the cell characterization tools meeting the exact procedure as being employed by the library developers. It was expected not only to substantially speed up and improve the cell characterization process but also reduce the cost of deployment of multiple licenses of generic cell characterization tools.

Approach

The delivery team realized that the key to the success of the project was the precise understanding of the cell characterization process being employed by the customer. And to get a real feel of the process and the pain points for the library designers, the team decided to invest time and resources to actually get involved in cell characterization.

Hence, a pilot team of library developers was set up to provide cell characterization services to the client. The first hand experience of this team was instrumental in drawing the specifications for the development of automatic cell characterization tool suite. Once the specifications were correctly drawn up, a Turnkey Project model was adopted for the development of the software.

Cell Characterization Tool Flow



As the team found out, the client's cell characterization process included not only using the standard tools such as SPICE simulator, but also included using internally developed analog simulators. Moreover, not only the standard HDLs such as Verilog and VHDL, but also some other internal proprietary HDLs were to be supported.

Result

As a result of the engagement, a whole range of tools was developed for the specific requirements of the client. This comprehensive cell characterization tool suite included the following features:

- Core Cell characterization: To characterize the pin-to-pin delays, input slew rates, input capacitances, maximum power dissipation, setup and hold timing values and so on. The characterization was able to handle different process corners as specified by the designers.
- HDL model generators: The complete simulation models for Verilog, VHDL and client's proprietary HDLs were generated.
- Model Validator: The digital models generated are compared against their true analog behavior at

different loads.

- Automatic document generation: The entire databook for the library could be generated in FrameMaker and HTML formats. The datasheets included logic equation, symbols, functional table, timing/delay values, timing diagram etc all of which were generated automatically.

The project was a major success owing to the effort invested in understanding the customer's cell characterization process and the close communication with the customer's internal library development team maintained throughout the engagement. Development of the tool was followed by on-site training of the client team on the tool.

The client has been able to make very extensive usage of this tool suite for all internal purposes. The benefits of increased efficiency and accuracy of the cell characterization process as well as the licensing cost savings of off the shelf tools have led to a high return on investment for the customer.