SiFive

# T2B IBIS Modeling for tsmc7nm HBM4Gbps I/O Design

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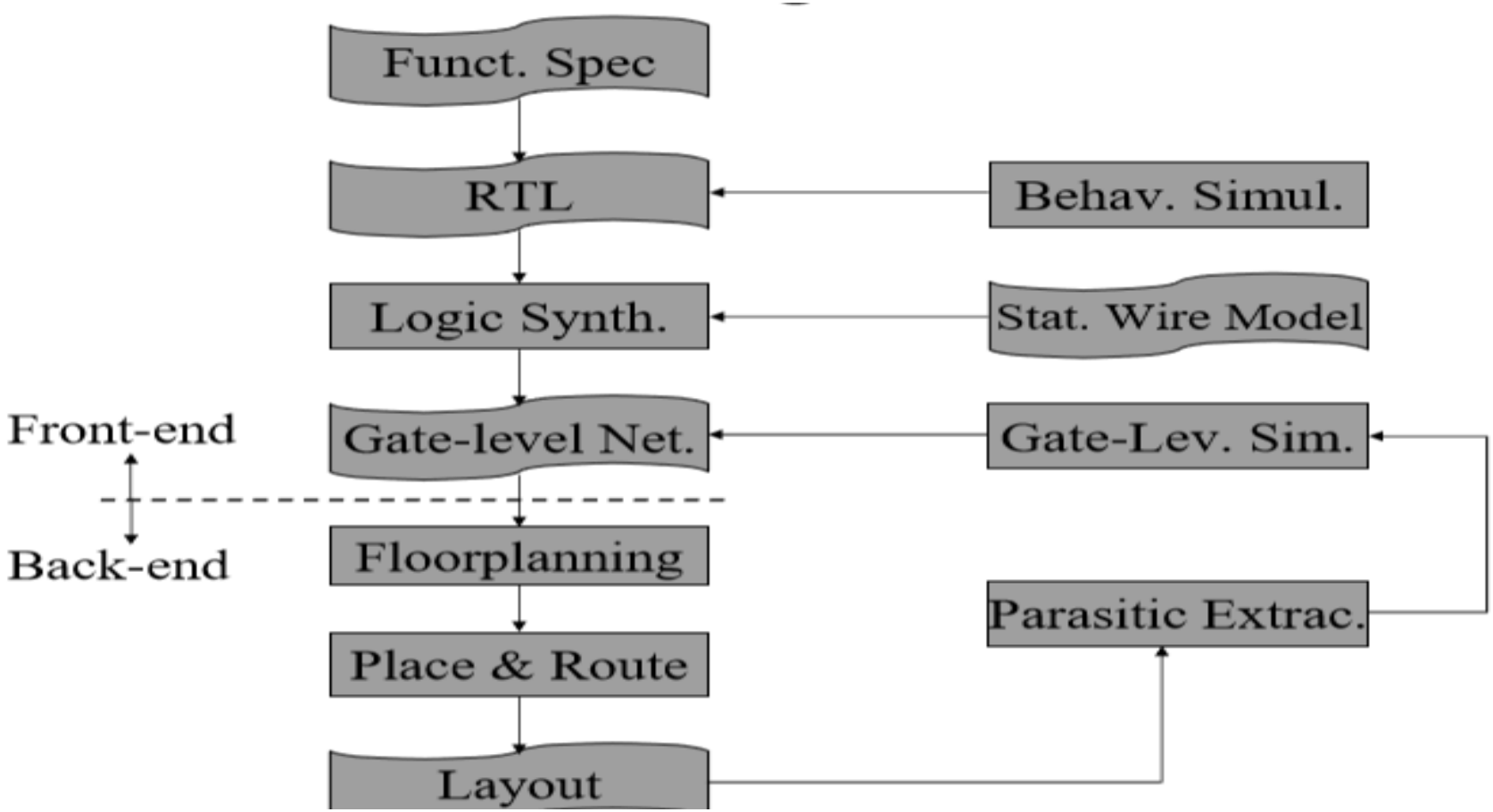
# Chip Design Flow



# Problem Statement

- IBIS models can be obtained by gathering data in simulations, or from Test bench measurements.
- If the former method is chosen, SPICE can be used to run the simulations and collect the V/I and V/T data for each of the input/output buffers This allows process corner data to be included in the models. Then, using one of the SPICE-to-IBIS conversion programs we can generate the ibis file.
- It required deep level understanding of design to generate the ibis using others tool.
- In addition to this we should aware of spice language to run the testbench.
- As a last step, the designer should validate the model by correlating the simulation results with actual silicon measurements.

# IBIS Model Generation Flow

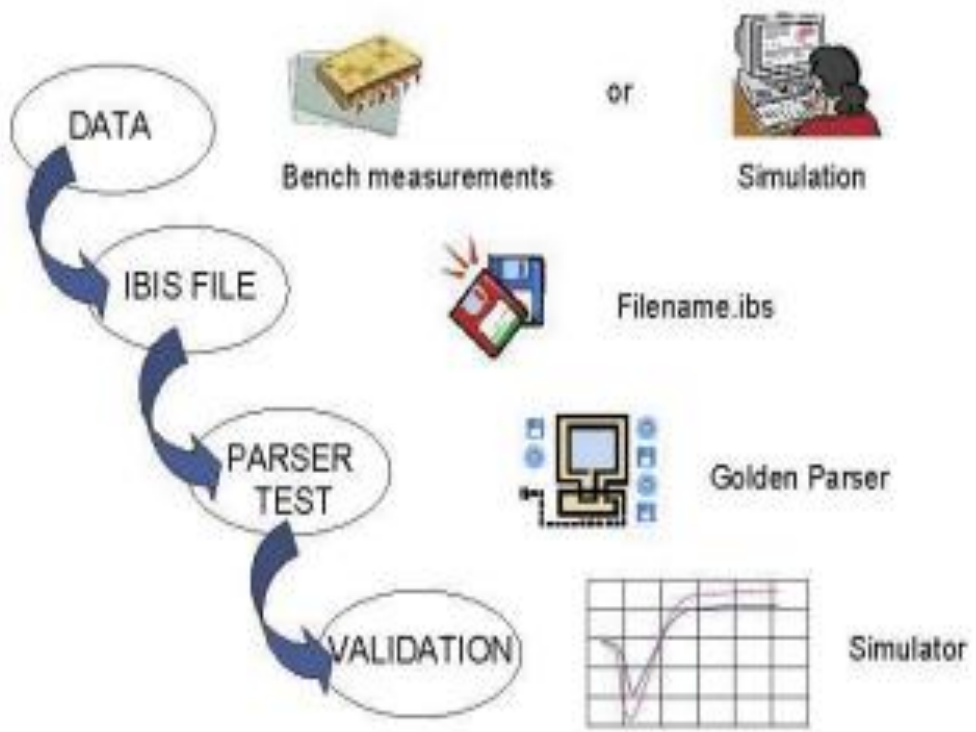



*Figure 1. IBIS Model Generation Flow*

- The models can be generated for three different corner conditions: typical, minimum, and maximum. In a typical model, the data will be obtained for nominal supply voltage, nominal temperature, and nominal process parameters; in a minimum model, the data will be obtained with the lowest supply voltage, high temperature, and weak process parameters; and for a maximum model, the conditions will be the highest supply voltage, low temperature, and strong process parameters.

- Each of these conditions leads to typical, slow, and fast models. A fast model is created by considering the highest current values with the fast transition time and the minimum package characteristics. On the other hand, the lowest current values with a slow transition time and maximum package values will produce a slow model.

# Goal

- **Efficient Method for one step IBIS generation.**

  ” Sigrity T2B”

- **Walk through comparison of full ibis generation flow**
  - In terms of time/effort
  - In terms of Quality/Accuracy

# REQUIRED DATA

- The IBIS specification supports several types of inputs and outputs that can be modeled three-state, open collector, open drain, I/O, and ECL, for example.

- The first step is to identify the different types of inputs and outputs on the device and determine how many buffer designs are present.

- It should be noted that one model can be used to represent more than one input or output in an IBIS file. However, separate models are required if the C_Comp and package parameters are different.

# MODEL TYPES (1/2)

Typical data must be supplied in the following. Min and Max data is optional. Model_type is a required parameter.

## 1)Input

An Input model functions only as a receiver. Vinl and Vinh (input threshold levels) must be defined. Power and/or Ground Clamp V-I curves must be define if they are supplied in the device.

## 2)Output

An Output model functions only as a Driver. Voh and Vol (output high and low limits) are not part of the IBIS spec. Most simulator companies put such information to good use, however. Power and/or Ground Clamp V-I curves must be defined if they are supplied in the device. Pullup and Pulldown V-I curves, as present in the device, must be supplied. This model always sources and/or sinks current and cannot be disabled.

## 3)I/O

This is a type of model where the pin is connected to device cells that can function either as a driver or a receiver depending on the enabling logic.

## 4)3-state

This is a type of driver model. It indicates that an output can be disabled. That is, put into a high impedance state.

# MODEL TYPES (2/2)

## 5)Open-drain

This is a type of driver model with an open pullup side. This name is retained for backward compatibility.

## 6)I/O_open_drain

This device indicates a combination of I/O and Open_drain behavior.

## 7)Open_sink

This is a type of driver model with an open pullup side. The user supplies a pullup resistor and power rail connection.

## 8)I/O_open_sink

This device indicates a combination of I/O and Open_sink behavior.

## 9)Open_source

This is a type of driver model with an open pulldown side. The user supplies a pulldown resistor and/or ground/pulldown rail.

## 10)I/O_open_source

This device indicates a combination of I/O and Open_source behavior.


# Thank You