Silicon Integration Initiative

CMC OMI - Open Model Interface

MOS-AK Meeting Dec. 2015

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December 17, 2015

Traditional Model Library Approach

History:

With devices shrinking in size layout implementation is not reflected in the basic device model card and cover all the components to realize an electrical device in a circuit. Traditionally people have included sub-circuits round the basic device model card to get the full electrical representation but this involves extra elements in the circuit matrix to be solved. With circuits containing more and more elements this just multiplies the problem of the matrix size to be manipulated and solved at every step of the simulators analysis stage.

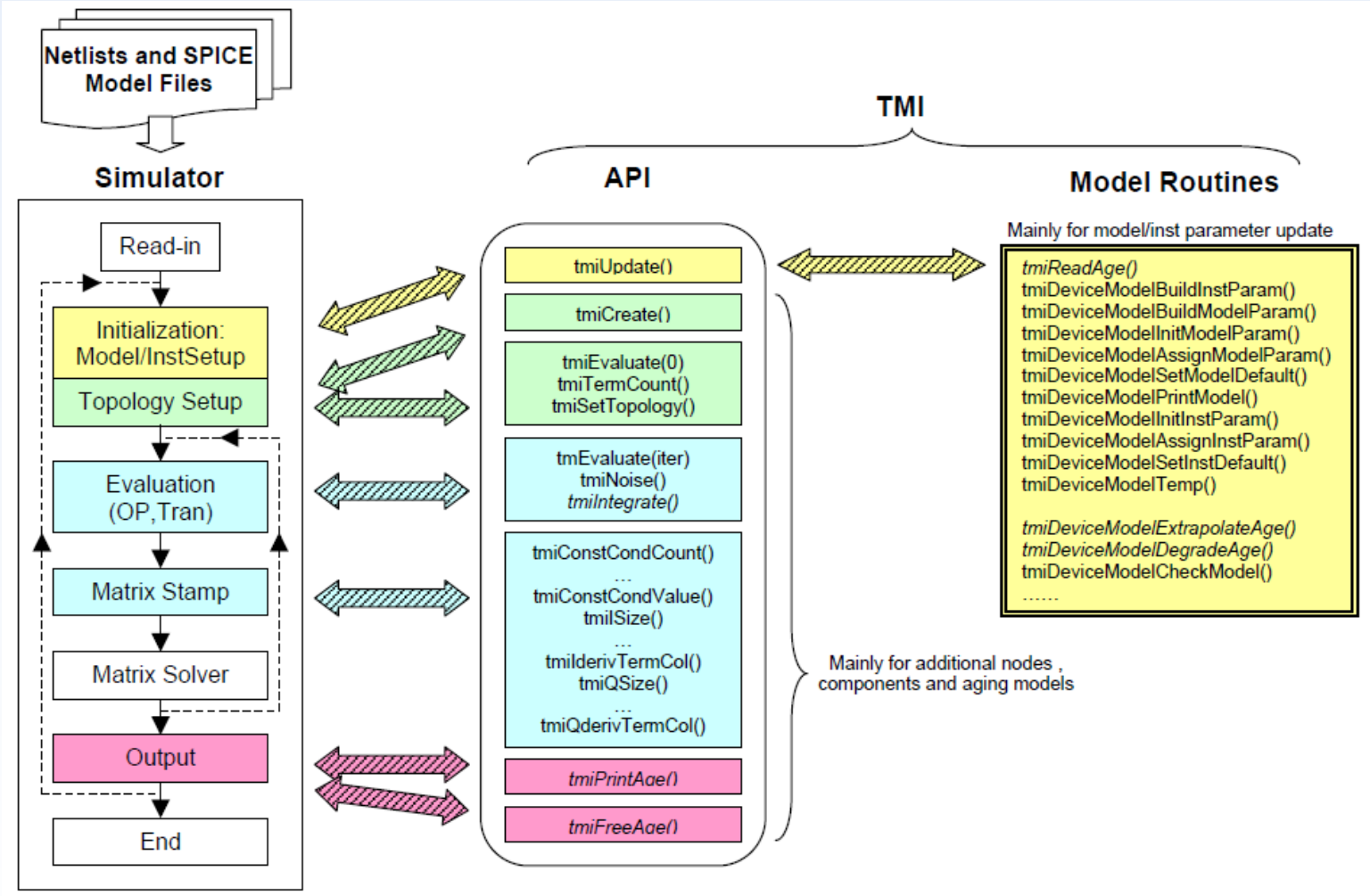
Change:

A different approach is to have an extra compute shell around the basic model card to calculate and feedback different model parameters to the basic model card. In this way the circuit matrix does not expand and a speed improvement in simulation time is seen as the solver has less elements to manage compared to the sub-circuit approach. This is the basis of the Open Model Interface (OMI)

This type of simulation approach was first done by TSMC with limited users but is now Licensed to the CMC to develop and make available to all simulator vendors and foundries.

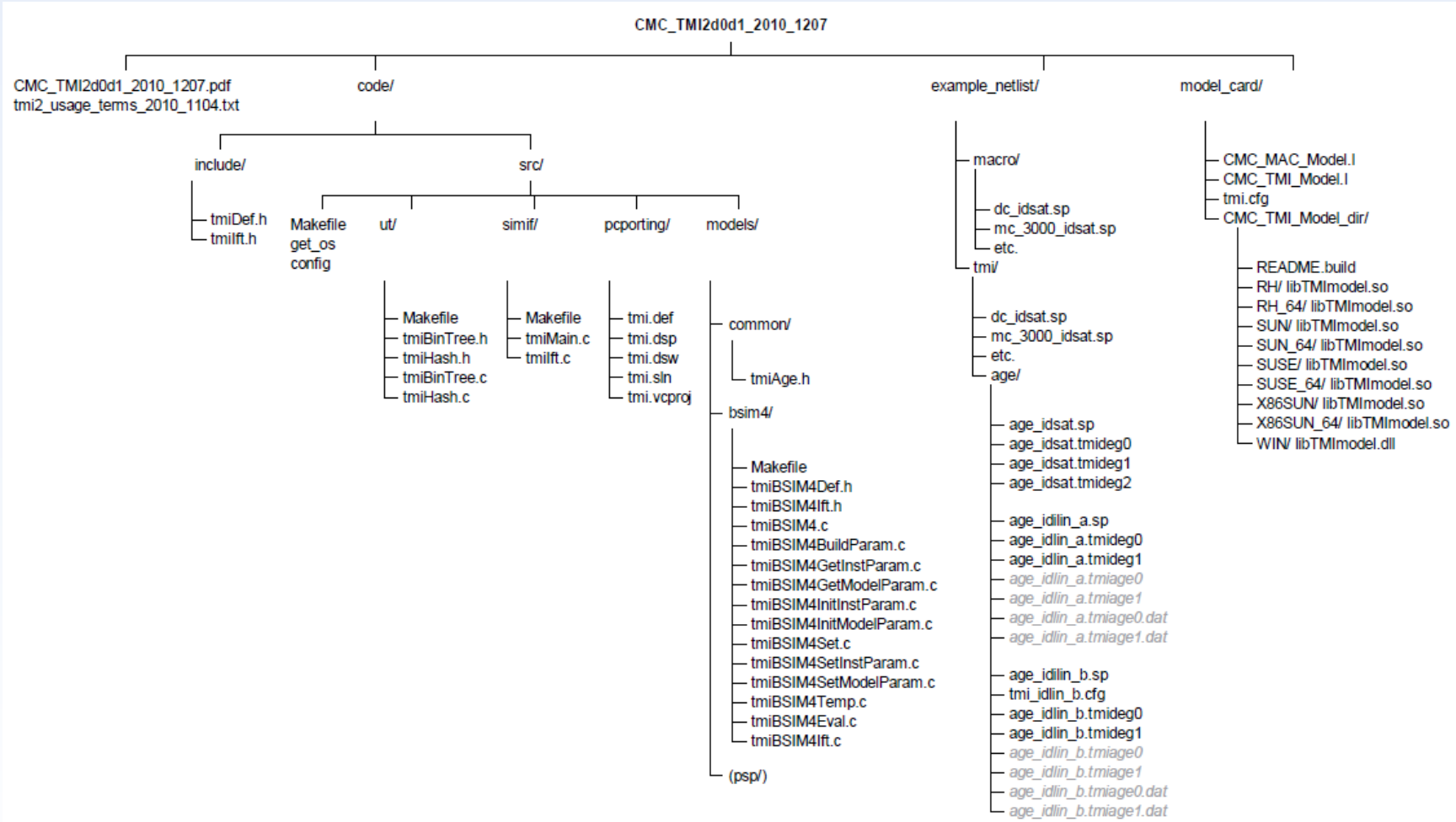
Here is example of the interactive flow:

OMI – Simulation flow



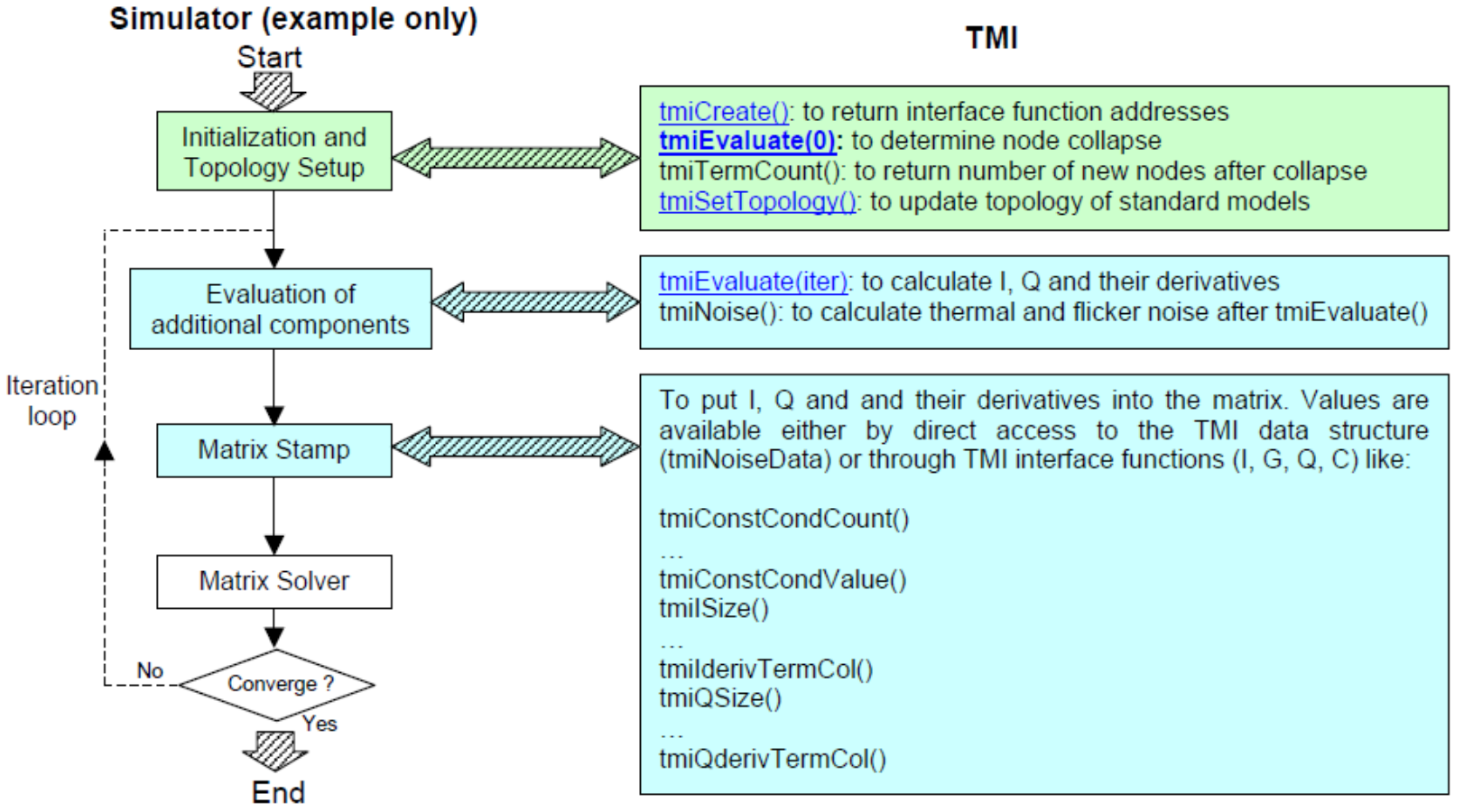
OMI flow overview and interaction with simulator

TMI – OMI File structure

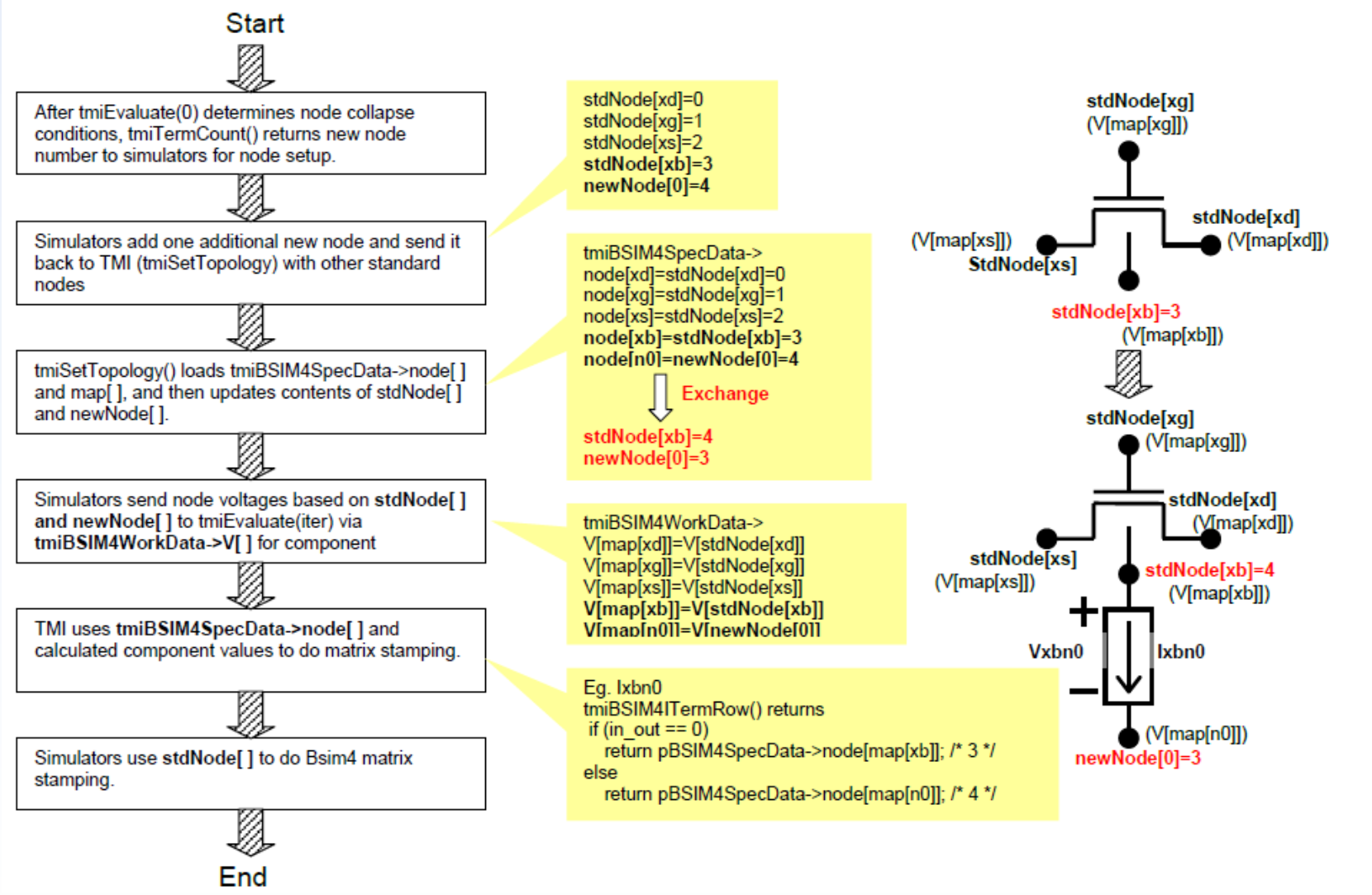


OMI – TMI Additional capability

- As well as interacting with the existing model and matrix to be solved extra elements in the matrix can be added:



Adding resistor element to circuit Topology



OMI Expanding Development

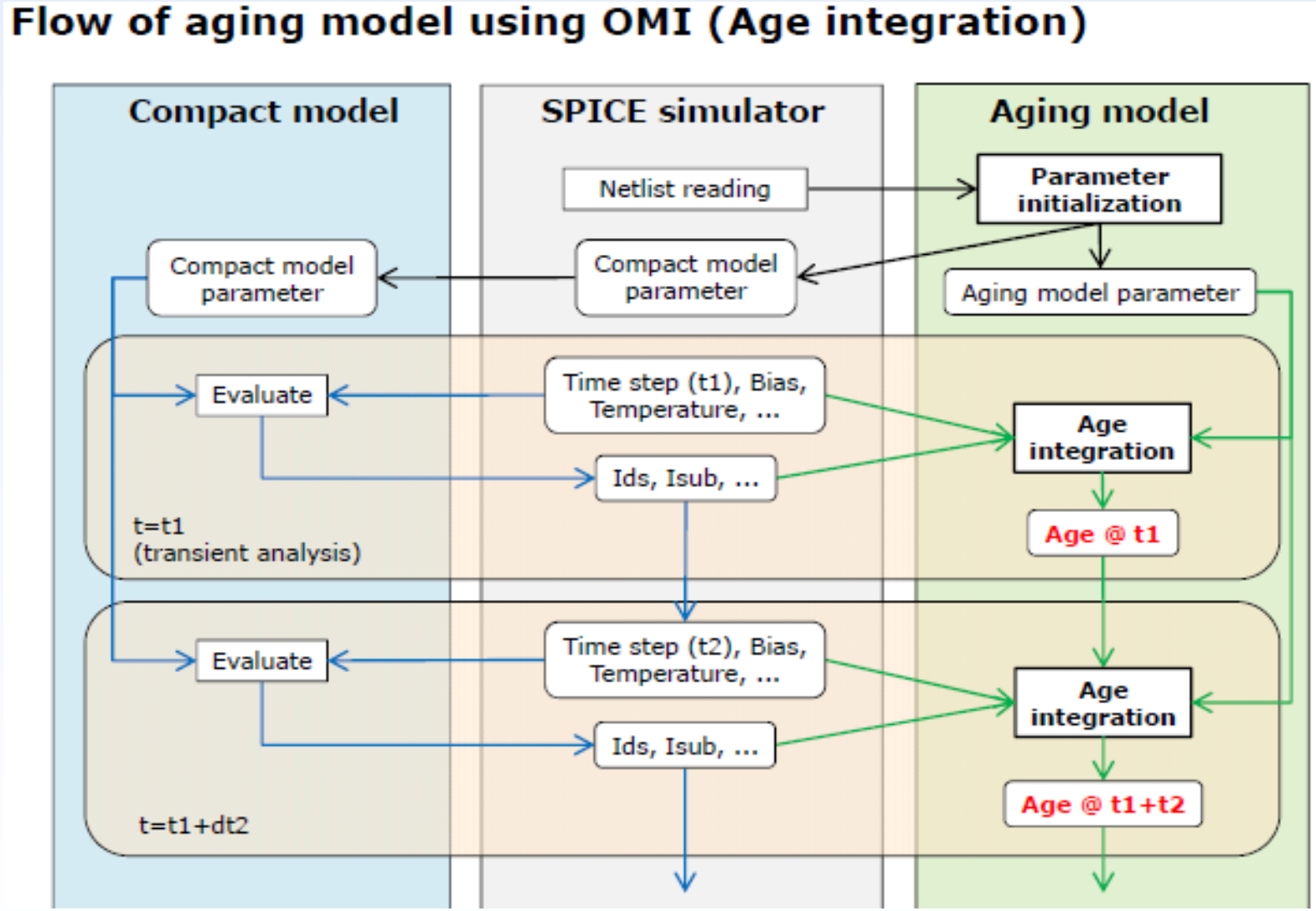
Development:

Development has lead to more than the original BSIM4 model and now we have BSIM-CMG (106.1), HiSIM2 and BSIMSOI added models.

We supply a model inclusion guide with the present code available to CMC members only at the moment while we test further the Beta release. We will release as a common standard for all to use once Beta testing and feedback s complete. CMC members will have access to a QA suite to validate the implementation of the model and reference results. Non CMC members will get the basic information without the QA suite.

Next I present one implementation using the HiSIM2 model to look at device degradation as the device is powered over a period of time:

Traditional Model Library Approach



OMI Expanding Development

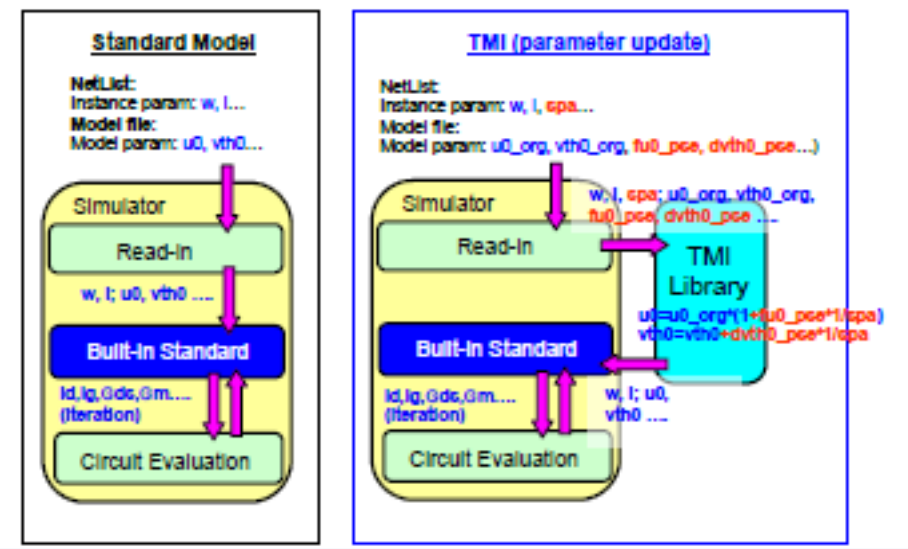
Current activity:

While testing the Beta release we are looking to expand the simulator test cases to further exercise the model functionality. We are also expanding into Verilog-A as many models are now being released in this format.

This will require further expansion for extra parameter structures. To implement this capability we will need different model allocations since Verilog-A can be done for any model rather than one specific case like BSIM4. We are currently exploring the structures required for this functionality within the working group.

This will enable quick addition to the capability of OMI to add a lot more models into this interface.

OMI – Verilog-A considerations



OMI flow vs simulator parameter update flow to consider

CMC OMI Summary

Achievements:

1. 3 CMC standard models ready for OMI beta release
   BSIM4 BSIM-CMG HiSIM2
   (original code had just one simple device model case)
2. Set of test decks to test model interface and basic model functionality for all incorporated models – still expanding
3. Showed a reliability test using OMI interface
4. Ready to release beta 1 code for Group member feedback on flow and parameter usage

Future Plans:

1. Get test feeback on OMI flow and model functionality
2. Schedule incorporating OMI in vendor simulators
   (talk with vendors to get schedule for interface in simulators)
   (Cadence, Synopsys, Mentor, Silvaco, ProPlus etc.)
3. Look at incorporating other CMC standard models – people asked about HiSIM_HV and Mextram etc.
4. Continue exploring Reliability expansion
5. Look at core model structuring, since now so many models incorporated,

Issues to Resolve:

1. Version implementation in Final release
2. Decide about CMC QA test suite and what we include in public release
3. Will be talking to vendors to sort out simulator implementation time line

Thankyou to CMC members testing our releases and providing feedback
also for contributing model information

- Please let me know if you want more information
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