Size Matters – Recent Experiences with IBIS Files

Size/Complexity Evolution and Implications for Model Users and EDA Tools

Ralf Brüning, Michael Schäder
Zuken EMC Technology Center
Paderborn - Germany

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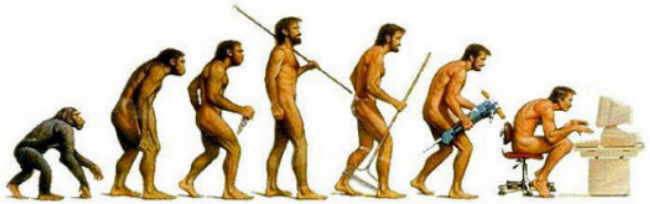
Preface

1. This is NOT one if these *‚in the good old days‘* presentation.

2. We like to share experiences and observation we made in the last 12 months which make model usage for the people in the CAD departments (which are often not IBIS experts) more difficult.

3. This is meant as a proposal for discussion between model makers, tool vendors and model users.

4. Of course we recognize technology evolution and that modern high sophisticated and complex silicon defines serious challenges to the model makes (and the model users) !



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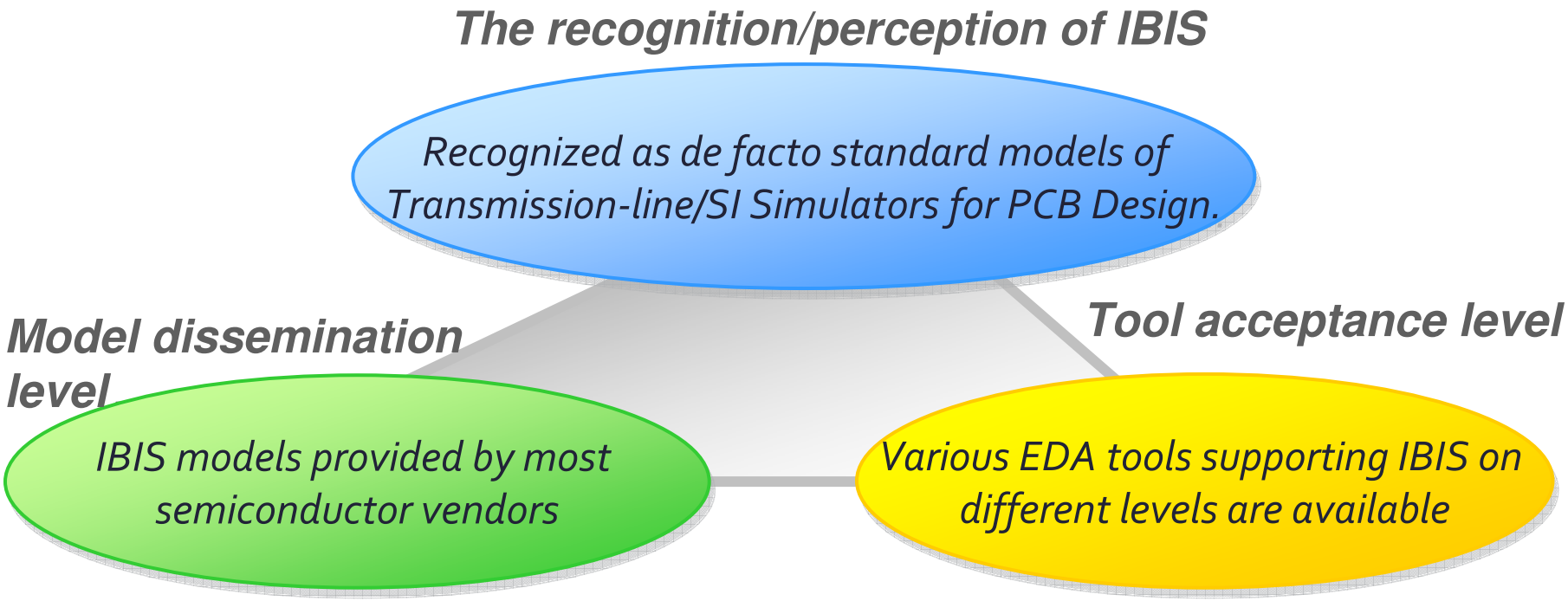
Recognition of IBIS



Looking overall, IBIS environment is very well accepted
(thats what we hope to archieve in the early 90ies...)

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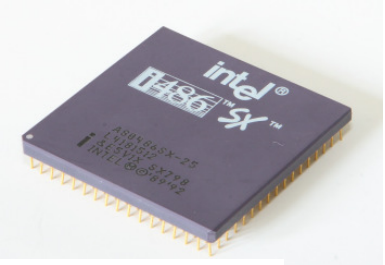
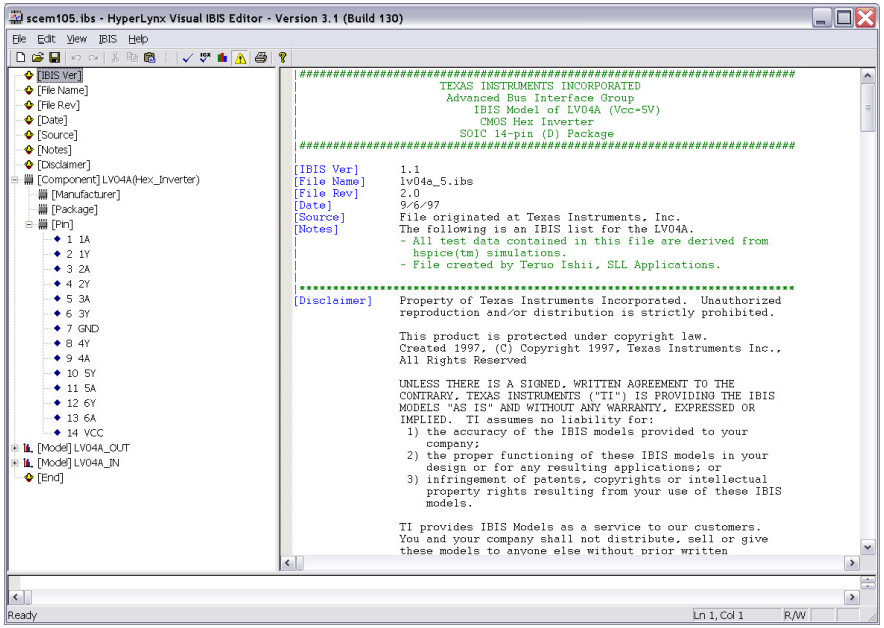
The Beginning ...

IBIS in the beginning has been defined when we had rather simple devices:

- SOP and PLCC packages, few models, simple RLC packages
- Lateron processor models, more complex packages
- DIMM modules as EBDs with IBIS 3.x





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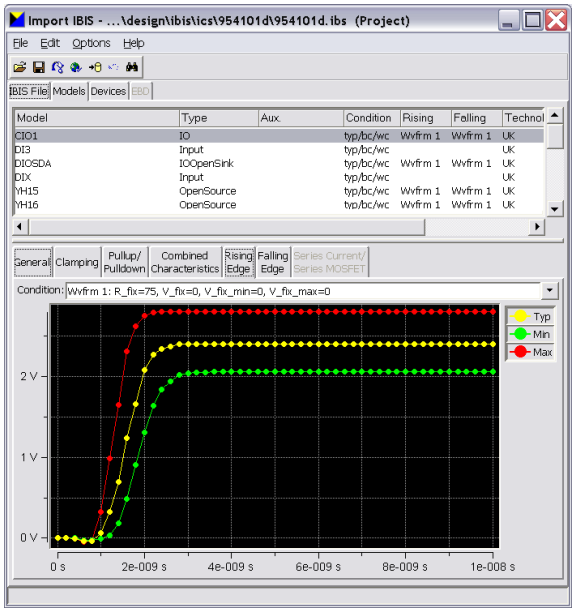
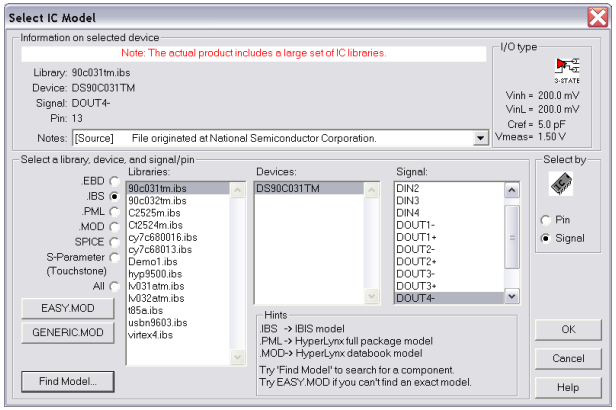
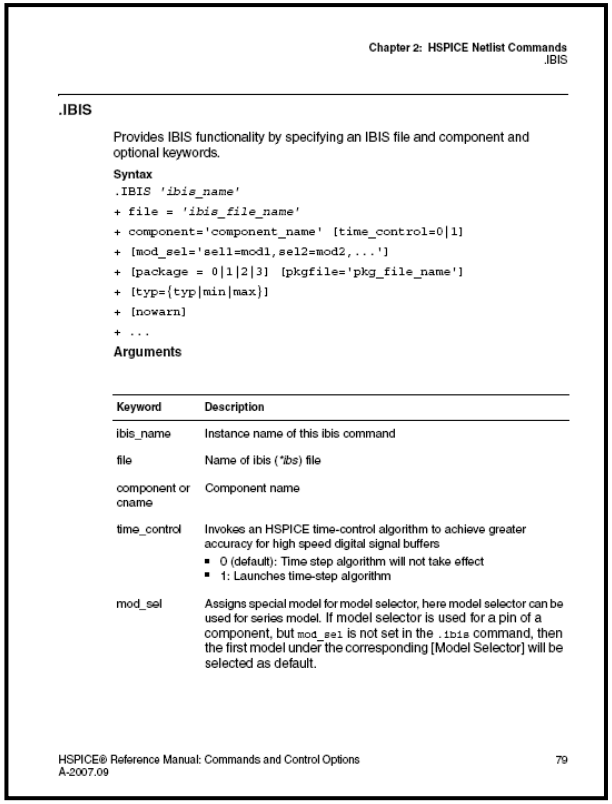
IBIS Data Usage in todays EDA Tools

- EDA Tools either read IBIS at runtime or they convert into own model formats (ako import and conversion process) or instantiate such models (i.e. HSPICE)
- When using the golden parser (to some extend most EDA tools utilize it) IBIS relevant data structures are created → huge operations in memory will take place







Chapter 2: HSPICE Netlist Commands
.IBIS

.IBIS

Provides IBIS functionality by specifying an IBIS file and component and optional keywords.

Syntax

```
.IBIS 'ibis_name'
+ file = 'ibis_file_name'
+ component='component_name' [time_control=0|1]
+ [mod_sel='sel1=mod1,sel2=mod2,...']
+ [package = 0|1|2|3] [pkgfile='pkg_file_name']
+ [typ={typ|min|max}]
+ [nowarn]
+ ...
```

Arguments

Keyword	Description
ibis_name	Instance name of this ibis command
file	Name of ibis (*'ibs*) file
component or cname	Component name
time_control	Invokes an HSPICE time-control algorithm to achieve greater accuracy for high speed digital signal buffers ▪ 0 (default): Time step algorithm will not take effect ▪ 1: Launches time-step algorithm
mod_sel	Assigns special model for model selector, here model selector can be used for series model. If model selector is used for a pin of a component, but `mod_sel` is not set in the `.ibis` command, then the first model under the corresponding [Model Selector] will be selected as default.

HSPICE® Reference Manual: Commands and Control Options
A-2007.09
79

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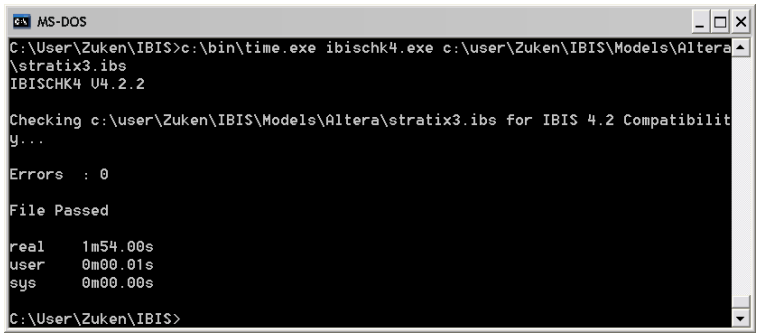
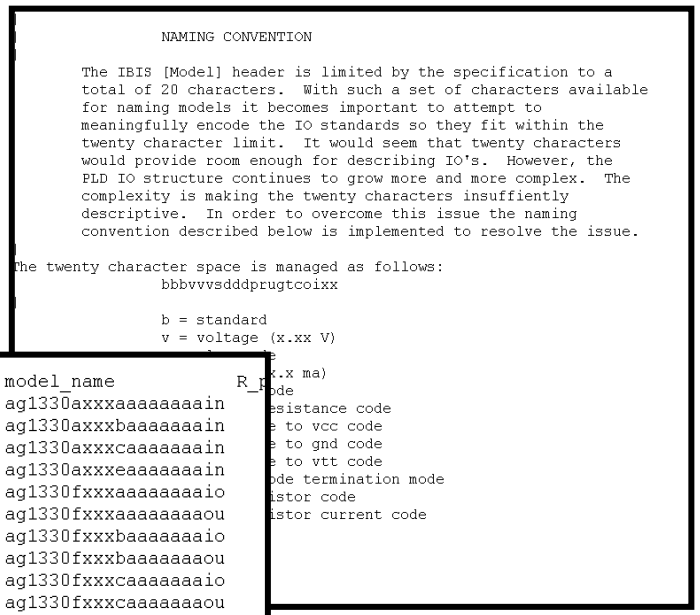
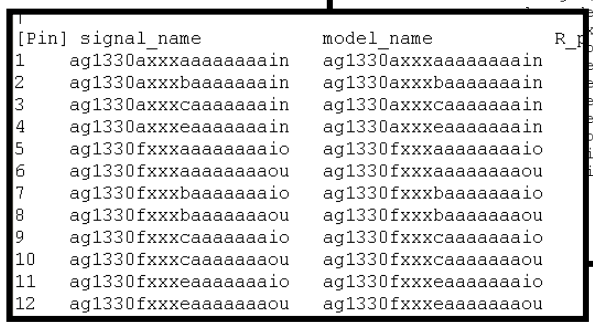
The Problem (1): IBIS file sizes explode

- Some recent samples:
  - Altera Stratix III:
    - 68.1 MB file size
    - 2359 (generic) pins, 7077 model PLUS model selector variants (OCT variation)
    - Passed IBISCHK (2 minutes on a fast PC) , but some IBIS freeware (editor) have problems
    - For the end user excellent XLS documentations allows model selection (but: manual process, error prone)
  - Lattice sc2.ibis
    - More then 80 MB
    - 2163 (generic) pins
    - Very ‚special' model naming scheme







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The Problem (2): Use of Model Selector Statements get a massive Commodity

- Up to 30 model selectors in some cases, problem often not direct visible to model users
  - Micron/Samsung EBDs
  - FPGAs

```
|
[Model Selector] DQ
|
DQ_FULL_533           Full-Strength IO Driver with no ODT
DQ_FULL_ODT50_533     Full-Strength IO Driver with 50 Ohm ODT Submodel
DQ_FULL_ODT75_533     Full-Strength IO Driver with 75 Ohm ODT Submodel
DQ_FULL_ODT150_533    Full-Strength IO Driver with 150 Ohm ODT Submodel
DQ_HALF_533           Reduced-Strength IO Driver with no ODT
DQ_HALF_ODT50_533     Reduced-Strength IO Driver with 50 Ohm ODT Submodel
DQ_HALF_ODT75_533     Reduced-Strength IO Driver with 75 Ohm ODT Submodel
DQ_HALF_ODT150_533    Reduced-Strength IO Driver with 150 Ohm ODT Submodel
DQ_FULL_800           Full-Strength IO Driver with no ODT
DQ_FULL_ODT50_800     Full-Strength IO Driver with 50 Ohm ODT Submodel
DQ_FULL_ODT75_800     Full-Strength IO Driver with 75 Ohm ODT Submodel
DQ_FULL_ODT150_800    Full-Strength IO Driver with 150 Ohm ODT Submodel
DQ_HALF_800           Reduced-Strength IO Driver with no ODT
DQ_HALF_ODT50_800     Reduced-Strength IO Driver with 50 Ohm ODT Submodel
DQ_HALF_ODT75_800     Reduced-Strength IO Driver with 75 Ohm ODT Submodel
DQ_HALF_ODT150_800    Reduced-Strength IO Driver with 150 Ohm ODT Submodel
|
```

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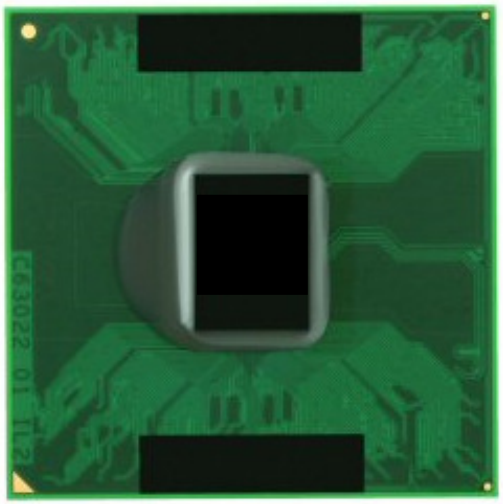
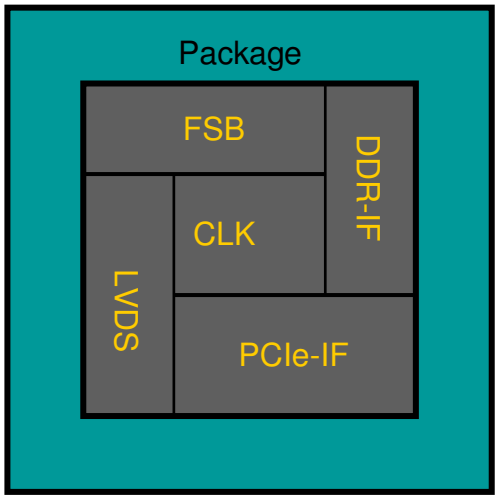
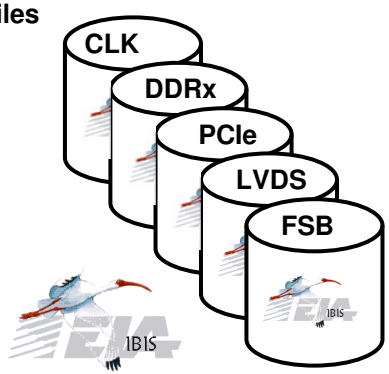
The Problem (3): Splitted IBIS files, Seperate package
(here large processor model)

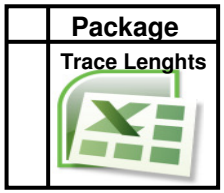




Hand Work needed !!!

Various IBIS Files





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Observations

- New devices are often modeled by really HUGE IBIS device descriptions with thousands of models
- New memory modules utilizes heavily EBDs (the renaissance of the EBDs, caused by DDRs modules)
- Package models often missing, or implicit set to zero and external package model is referred in SPICE or S-Parameters synthax → often further handwork

⇨ IBIS gets less handy for model users (then intended ?)

```
[Component]      Pentium_M_rev13
[Manufacturer]   Intel Corporation
|
[Package]
|                typ              min              max
R_pkg            0.0000Ohm        0.0000Ohm        0.0000Ohm
L_pkg            0.00H            0.00H            0.00H
C_pkg            0.00F            0.00F            0.00F
|
| User selects a package model by uncommentting one the following models.
[Package Model]    bnspkg_fsb_single_line
|[Package Model]    bnspkg_fsb_odd
|[Package Model]    bnspkg_fsb_even
|
|*********************************************************************************
```

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Conclusion

- The recent development on (some) IBIS device descriptions makes the model usage, especially for less experienced users, mode complicated
- Tools can still handle such devices, but if this development continues, IBIS data handling can become challenging
- Handwork will lower down the convinience and acceptance in using IBIS and therefore may harm the progress of the standard.

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