



## IBIS Open Forum Minutes

Meeting Date: **May 14, 2014**

Meeting Location: **SPI-E IBIS Summit, Ghent, Belgium**

### VOTING MEMBERS AND 2014 PARTICIPANTS

Agilent Technologies	Radek Biernacki, Nilesh Kamdar, Colin Warwick, Graham Riley, Pegah Alavi, Fangyi Rao, Heidi Barnes, Dimitrios Drogoudis*
Altera	David Banas, Kundan Chand, Hsinho Wu
ANSYS	(Steve Pytel)
Applied Simulation Technology	Fred Balistreri, Norio Matsui
Cadence Design Systems	Ambrish Varma, Brad Brim, Joy Li, Kumar Keshavan, Ken Willis, Yingxin Sun, Joshua Luo, John Phillips
Ericsson	Anders Ekholm*, Zilwan Mahmud*
Foxconn Technology Group	(Sogo Hsu)
Huawei Technologies	Jinjun Li, Xiaoqing Dong, Zanglin Yuan*, Han Li*
IBM	Adge Hawes
Infineon Technologies AG	(Christian Sporrer)
Intel Corporation	Michael Mirmak, Jon Powell, Riaz Naseer Udy Shrivastava, Mustafa Yousuf, Jimmy Jackson Pietro Brenner*
IO Methodology	Lance Wang, Michelle Coombs
LSI	Xingdong Dai, Min Huang, Anaam Ansari, Brian Burdick
Maxim Integrated Products	Hassan Rafat
Mentor Graphics	Arpad Muranyi, John Angulo, Fadi Deek, Chuck Ferry* Thomas Groebli*
Micron Technology	Randy Wolff*
Qualcomm	(Senthil Nagarathinam)
Signal Integrity Software	Mike LaBonte, Walter Katz, Todd Westerhoff, Michael Steinberger
Synopsys	Ted Mido, Scott Wedge
Teraspeed Consulting Group	Bob Ross, Tom Dagostino, Scott McMorro
Toshiba	(Yasumasa Kondo)
Xilinx	Ravindra Gali
ZTE Corporation	(Shunlin Zhu)
Zuken	Michael Schaefer*, Amir Wallrabenstein, Griff Derryberry Reinhard Remmert*

### OTHER PARTICIPANTS IN 2014

Continental Automotive	Catalin Negrea*
CST	Stefan Paret*
ECL Advantage	Thomas Iddings
Hewlett Packard	Ting Zhu

Instituto de Telecomunicações	Wael Dghais*
KEI Systems	Shinichi Maeda
Lattice Semiconductor	Xu Jiang
Mellanok Technologies	Piers Dawe
Nanium	Abel Janeiro*
Pangeya	Edgar Aguirre
Proficient Design	Kishor Patel
SAE International	Chris Denham
Technische Universität Hamburg	Torsten Reuschel*
University of Illinois	José Schutt-Ainé*
Vitesse	Siris Tsang

In the list above, attendees at the meeting are indicated by \*. Principal members or other active members who have not attended are in parentheses. Participants who no longer are in the organization are in square brackets.

## UPCOMING MEETINGS

The bridge numbers for future IBIS teleconferences are as follows:

Date	Meeting Number	Meeting Password
May 23, 2014	205 475 958	IBIS
June 5, 2014	IBIS Summit at DAC – no teleconference	
June 20, 2014	205 475 958	IBIS

For teleconference dial-in information, use the password at the following website:

<https://ciscosales.webex.com/ciscosales/j.php?J=205475958>

All teleconference meetings are 8:00 a.m. to 9:55 a.m. US Pacific Time. Meeting agendas are typically distributed seven days before each Open Forum. Minutes are typically distributed within seven days of the corresponding meeting. When calling into the meeting, follow the prompts to enter the meeting ID. For new, local international dial-in numbers, please reference the bridge numbers provided by Cisco Systems at the following link:

[http://www.cisco.com/web/about/doing\\_business/conferencing/index.html](http://www.cisco.com/web/about/doing_business/conferencing/index.html)

NOTE: "AR" = Action Required.

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## OFFICIAL OPENING

The IBIS Open Forum Summit was held in Ghent, Belgium at the Het Pand convention center following the 2014 SPI conference. About 17 people representing 13 organizations attended.

The notes below capture some of the content and discussions. The meeting presentations and

other documents are available at:

<http://www.eda.org/ibis/summits/may14/>

Randy Wolff welcomed all the participants and thanked the sponsor Zuken. He asked all the participants to introduce themselves. There were a wide variety of people from many countries and organizations including academia and industry.

### **MIXED-DOMAIN IBIS MODEL EXTRACTION AND IMPLEMENTATION**

Wael Dghais and Jonathan Rodriguez, Universidade de Aveiro, Instituto de Telecomunicações, Portugal

Wael Dghais presented an IBIS-like behavioral buffer model implementation. The model's functions, which include the nonlinear conduction (I-V) and the displacement (Q-V) characteristics, were extracted from bias-dependent S-parameter data. Pre-driver filters were extracted from observed V-T switching data. Combinational and sequential processing was used to implement the conditionally executed subsystems to account for the pre-driver nonlinear dynamics. The measurement-based and table-driven behavioral models from mixed-domain extraction were implemented as LUTs in MATLAB. This presents an alternative solution for the IBIS extraction and the VHDL-AMS implementation. Wael commented that the model was generated for I/O interfaces designed in CMOS bulk technology. The model would need to be extended for buffers designed in FD-SOI technology.

Randy Wolff asked how similar the modeling approach is to current techniques of I-V and V-T extraction using a single netlist. Wael responded that data table extraction is not too different, but implementation is different. A convolution approach for mapping of time domain pullup and pulldown transitions is used. With event driven simulators with triggers, the model can be implemented easily. FIR filters can be different RC circuits that are multiplexed.

Randy asked what improvements Wael plans to work on next. Wael responded that power integrity and overclocking are next improvements. He needs to investigate how to handle the non-linearities of power changes. The currently modeled design is a 300Mb/s I/O. The model will have problems with overclocking at twice that data rate.

### **INTERCONNECT TASK GROUP UPDATE – PACKAGE MODELING**

Randy Wolff, Micron Technology, USA

Randy Wolff presented an overview of recent work done by the Interconnect task group for advancing package and on-die interconnect modeling in IBIS. Walter Katz presented information at the DesignCon IBIS Summit describing which interconnect descriptions belong within the IBIS file and which belong in a separate file modeled with a proposed specification for enhanced-EBDs. Since that time, the task group looked at two proposals for package modeling syntax as either extensions to [External Circuit] or new keywords under [Define Package Model]. The task group recently voted to focus on developing the proposal defining new keywords under [Define Package Model]. Randy presented some details of the current proposed syntax. The syntax will be changed regularly until a final BIRD is ready for introduction to the IBIS Open Forum. The task group also plans to work concurrently on an

overhaul to the EBD specification.

Michael Schaefer asked if IBIS intends to support EBD and EMD at the same time. He'd prefer to have a single solution to support. A comment was made that having a new file extension for new EBD models is preferred.

Chuck Ferry asked why one wants to support stacked memory outside of the IBIS file. Randy responded that he can support any syntax. Due to the complexity in the EDA software required to handle multi-chip packages and stacked memory, it is desirable to model these devices using EBD-like syntax that is external to the IBIS file. Randy added that this is an opportunity for someone to create software to support creation of new EBD files.

Michael asked how EDA software is supposed to determine worst case victim/aggressors from a package model. The software is more suited to looking at board-level coupling. Randy responded that victim/aggressor package models are intended to be used pre-layout. Chuck commented that this seems difficult to support, as a tool may have different victim/aggressor setups at a board level. Randy noted that the approach was meant to be a pre-layout model that may be worst case and could be applied to any board level setup. There are existing models coming from vendors, and we are looking at how to support these.

Randy encouraged people to provide feedback now while the task group is actively working on the BIRD.

## **IBIS AMI VALIDATION**

Zilwan Mahmud and Anders Ekholm, Ericsson, Sweden

Zilwan Mahmud began by describing design goals he has with IBIS AMI analysis. IBIS AMI models must be validated, as correct and validated models are needed. Certification is the first step a model must go through to check that the model behavior is reasonable. Zilwan presented a long checklist of items to verify. To do active correlation, the PCB model in simulation must be adjusted to match the real channel characteristics as seen in measurements. S-parameters from measurement can be used in the correlation exercise, but the PCB models need to be adjusted for later use in post-layout simulation. TX active validation is feasible, but RX active validation is not, because measurements at the decision point are not possible.

Zilwan's experience shows that many models fail certification for various reasons such as syntax errors, run time errors, simulated DC levels that don't match measured DC levels, idealized analog models, etc.

Chuck Ferry asked if vendors were providing S-parameters for the analog portion of the model. Zilwan responded that some models do. They are using a VNA to measure S-parameters for the correlation channel. Chuck asked if for cases with good correlation, are the models using S-parameters providing better correlation? Zilwan responded that he see problems with all models.

Randy Wolff asked if they had measured the analog portion of any RX models. Zilwan said that

they still need to do this.

Michael Schaefer asked if some models have been good. Anders Ekholm responded that all models have had problems.

Randy asked how you determine if the model is good enough. Zilwan responded that characteristics of the measurement should fall within slow/fast boundaries defined by the model.

A question was asked about what temperatures were measured. Zilwan responded that they only measured at room temperature.

### **IBIS FILE INSPECTION USING IBISINF – A BASIC UTILITY FOR THE 80/20 RULE**

Michael Schaefer, Zuken, Germany

Michael Schaefer presented on a freely available command line tool developed by Zuken. The utility, `ibisinf`, is based on the IBIS parser but checks only `.ibs` files. It allows quick overview of legacy IBIS files. Information about components and models can be printed out to check for completeness. The utility can also pull data tables from models out of the IBIS file into external files for import to standard office tools. Michael noted that the utility could be improved to output information on component pins, package data, and to support AMI models. He also asked if we want to integrate this utility into `ibischk`. The code could be integrated with reasonable effort from Zuken.

Randy Wolff asked if one could import an IBIS 5.0 power-aware model. Michael responded that this capability could be added very easily.

A question was asked if the utility was documented. Michael responded that it is documented on the IBIS site as well as with his presentation.

### **IBISCHK5/6 SPECIFICATION DOCUMENT UPDATE**

Bob Ross\* and Mike LaBonte\*\*, \*Teraspeed Consulting Group and \*\*Signal Integrity Software (SiSoft), USA

Anders Ekholm presented information about a specification document being developed for the IBIS parser. Bob Ross and Mike LaBonte are working on this document. The `ibischk5` parser can output numbered error, warning, note, caution and bug messages. There are 1200+ unique message strings being documented. Bob and Mike have developed a semi-automated process for this. A resulting spreadsheet includes expanded comments for some messages. The `ibischk6` parser will be released sometime in May, and the document will be updated to document it.

Michael Schaefer asked how to request getting the `ibisinf` utility integrated into `ibischk`. Anders responded that he may file it as an enhancement request.

José Schutt-Ainé asked if the parser code is available. Anders responded that it is to paid parser licensees. José asked if there is a discount for universities. Anders responded that

there is not a discount currently.

## **REVISITING THE IBIS VERSION RELEASE SCHEDULE**

Michael Mirmak, Intel Corporation, USA

Randy Wolff presented. In February 2012, Michael Mirmak presented a plan to move to a regular, software-like release plan for the IBIS specification. This release schedule would allow for better planning by the IBIS community, keep the number of changes manageable and reduce the parser development cycle time and cost. The original plan proposed two specification releases per year. After feedback from the 2014 DesignCon IBIS Summit, the proposal was revised to move to an annual release cycle that includes periods of time for technical development, editorial work and a quiet time for holidays and IBIS events. The proposal also looks to move to using date codes for the year and month of approval. This would also affect the parser. If implemented this year, the next version of IBIS would be 2014.11, and BIRDs would need to be approved by August 1, 2014. Membership dues in 2015 could also see parser development fees become part of the membership dues.

Michael Schaefer commented that he looked at the previous proposal, but he couldn't support twice per year releases. He and other participants expressed interest in the membership plus parser membership option. José Schutt-Ainé thought this might be a better way for his university to obtain a license of the IBIS parser.

Wael Dghais commented that there are many new technologies for Tx and Rx circuits in development. He thought it might be difficult for IBIS to keep current with these new technologies. Randy commented that the regular release schedule for IBIS could mean that new technologies could be supported by IBIS more quickly.

## **OPEN DISCUSSION**

José Schutt-Ainé asked how long it takes to develop IBIS models. Randy Wolff commented that it is more difficult to develop AMI models, and these could take a very long time. For legacy IBIS models, it could take one week to one month or more.

Wael Dghais commented that he did not like the requirement of determining weighting functions in IBIS. This makes transient simulation difficult. Michael Schaefer commented that you can determine these before run time and then use them in the simulation.

Wael had ideas about new algorithms for IBIS such as those presented earlier. Anders Ekholm discussed that this might require allowing deprecation so that models would not need V-T waveforms if they used new algorithms.

José noted that sometimes there is non-convergence with legacy IBIS models. Michael agreed and said that in that case you have to do additional processing on the models. Models with too few V-T points are particularly troublesome.

Wael commented that he saw better ways of creating models than the current IBIS algorithms, especially for pre-driver modeling for pre-emphasis drivers.

## **CLOSING REMARKS**

Randy Wolff closed the meeting by thanking the co-sponsors and the presenters. He also thanked all the attendees for making the meeting a success. The meeting concluded at approximately 4:40 PM.

## **NEXT MEETING**

The next IBIS Open Forum teleconference will be held May 23, 2014 from 8:00 a.m. to 10:00 a.m. US Pacific Time. A vote is scheduled on BIRD167.1. The following IBIS Open Forum Summit meeting will be held June 5, 2014 at DAC. There will be no teleconference. The following teleconference meeting will be held June 20, 2014.

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## **NOTES**

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This meeting was conducted in accordance with ANSI guidance.

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subscribe ibis <your e-mail address>

In the body, for the IBIS Users' Group Reflector:  
subscribe ibis-users <your e-mail address>

Help and other commands:  
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[ibis@eda.org](mailto:ibis@eda.org)

To send a message to the general IBIS Open Forum Reflector. This is used mostly for IBIS Standardization business and future IBIS technical enhancements. Job posting information is not permitted.

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[ibis-bug@eda.org](mailto:ibis-bug@eda.org)

To report ibischk parser BUGs as well as tschk2 parser BUGs. The BUG Report Form for ibischk resides along with reported BUGs at:

<http://www.eda.org/ibis/bugs/ibischk/>  
<http://www.eda.org/ibis/bugs/ibischk/bugform.txt>

The BUG Report Form for tschk2 resides along with reported BUGs at:

[http://www.eda.org/ibis/tschk\\_bugs/](http://www.eda.org/ibis/tschk_bugs/)  
[http://www.eda.org/ibis/tschk\\_bugs/bugform.txt](http://www.eda.org/ibis/tschk_bugs/bugform.txt)

[icm-bug@eda.org](mailto:icm-bug@eda.org)

To report icmchk1 parser BUGs. The BUG Report Form resides along with reported BUGs at:

[http://www.eda.org/ibis/icm\\_bugs/](http://www.eda.org/ibis/icm_bugs/)  
[http://www.eda.org/ibis/icm\\_bugs/icm\\_bugform.txt](http://www.eda.org/ibis/icm_bugs/icm_bugform.txt)

To report s2ibis, s2ibis2 and s2iplt bugs, use the Bug Report Forms which reside at:

<http://www.eda.org/ibis/bugs/s2ibis/bugs2i.txt>  
<http://www.eda.org/ibis/bugs/s2ibis2/bugs2i2.txt>  
<http://www.eda.org/ibis/bugs/s2iplt/bugspl.txt>

Information on IBIS technical contents, IBIS participants and actual IBIS models are available on the IBIS Home page:

<http://www.eda.org/ibis>

Check the IBIS file directory on eda.org for more information on previous discussions and results:

<http://www.eda.org/ibis/directory.html>

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## IBIS – SAE STANDARDS BALLOT VOTING STATUS

### I/O Buffer Information Specification Committee (IBIS)

Organization	Interest Category	Standards Ballot Voting Status	March 14, 2014	April 4, 2014	April 25, 2014	May 14, 2014
Agilent Technologies	User	Active	X	X	X	X
Altera	Producer	Active	-	X	X	-
ANSYS	User	Inactive	-	-	-	-
Applied Simulation Technology	User	Inactive	-	-	-	-
Cadence Design Systems	User	Active	-	X	X	-
Ericsson	Producer	Inactive	-	X	-	X
Foxconn Technology Group	Producer	Inactive	-	-	-	-
Huawei Technologies	Producer	Inactive	-	-	-	X
IBM	Producer	Inactive	-	X	-	-
Infineon Technologies AG	Producer	Inactive	-	-	-	-
Intel Corp.	Producer	Active	X	X	X	X
IO Methodology	User	Inactive	-	-	-	-
LSI	Producer	Inactive	X	-	-	-
Maxim Integrated Products	Producer	Inactive	-	-	-	-
Mentor Graphics	User	Active	X	X	X	X
Micron Technology	Producer	Active	X	X	X	X
Qualcomm	Producer	Inactive	-	-	-	-
Signal Integrity Software	User	Active	X	X	X	-
Synopsys	User	Inactive	-	-	-	-
Teraspeed Consulting	General Interest	Active	X	X	X	-
Toshiba	Producer	Inactive	-	-	-	-
Xilinx	Producer	Inactive	-	-	-	-
ZTE	User	Inactive	-	-	-	-
Zuken	User	Inactive	-	-	-	X

#### CRITERIA FOR MEMBER IN GOOD STANDING:

- MUST ATTEND TWO CONSECUTIVE MEETINGS TO ESTABLISH VOTING MEMBERSHIP
- MEMBERSHIP DUES CURRENT
- MUST NOT MISS TWO CONSECUTIVE MEETINGS

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