**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 Mahmod\*

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 McMorrow

Toshiba (Yasumasa Kondo)

Xilinx Ravindra Gali

ZTE Corporation (Shunlin Zhu)

Zuken Michael Schaeder\*, 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>

NOTE: "AR" = Action Required.

-------------------------------------------------------------------------------------------------------------------------------

**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/](http://www.eda.org/ibis/summits/may12/)

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 Schaeder 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 Mahmod and Anders Ekholm, Ericsson, Sweden

Zilwan Mahmod 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 Schaeder 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 Schaeder, Zuken, Germany

Michael Schaeder 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 Schaeder 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 Schaeder 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 Schaeder 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.

========================================================================

**NOTES**

IBIS CHAIR: Michael Mirmak (916) 356-4261, Fax (916) 377-3788

[michael.mirmak@intel.com](mailto:bob@teraspeed.com)

Data Center Platform Applications Engineering

Intel Corporation

FM5-239

1900 Prairie City Rd.,

Folsom, CA 95630

VICE CHAIR: Lance Wang (978) 633-3388

[lwang@iometh.com](mailto:lwang@iometh.com)

President/CEO, IO Methodology, Inc.

PO Box 2099

Acton, MA 01720

SECRETARY: Randy Wolff (208) 363-1764, Fax: (208) 368-3475

[rrwolff@micron.com](mailto:rrwolff@micron.com)

Principal Engineer, Modeling Group Lead, Micron Technology, Inc.

8000 S. Federal Way

Mail Stop: 01-711

Boise, ID 83707-0006

LIBRARIAN: Anders Ekholm (46) 10 714 27 58, Fax: (46) 8 757 23 40

[ibis-librarian@eda.org](mailto:anders.ekholm@ericsson.com)

Digital Modules Design, PDU Base Stations, Ericsson AB

BU Network

Färögatan 6

164 80 Stockholm, Sweden

WEBMASTER: Mike LaBonte

[mikelabonte@eda.org](mailto:mikelabonte@eda.org)

IBIS-AMI Modeling Specialist, Signal Integrity Software

6 Clock Tower Place

Maynard, MA 01754

POSTMASTER: Mike LaBonte

[mikelabonte@eda.org](mailto:mikelabonte@eda.org)

IBIS-AMI Modeling Specialist, Signal Integrity Software

6 Clock Tower Place

Maynard, MA 01754

This meeting was conducted in accordance with ANSI guidance.

The following e-mail addresses are used:

[majordomo@eda.org](mailto:majordomo@eda-stds.org)

In the body, for the IBIS Open Forum Reflector:

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:

help

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

To join, change, or drop from either or both:

IBIS Open Forum Reflector ([ibis@eda.org](mailto:ibis@eda-stds.org))

IBIS Users' Group Reflector ([ibis-users@eda.org](mailto:ibis-users@eda-stds.org))

State your request.

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

To obtain general information about IBIS, to ask specific questions for individual response, and to inquire about joining the IBIS Open Forum as a full Member.

[ibis@eda.org](mailto:ibis@eda-stds.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.

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

To send a message to the IBIS Users' Group Reflector. This is used mostly for IBIS clarification, current modeling issues, and general user concerns. Job posting information is not permitted.

[ibis-bug@eda.org](mailto:ibis-bug@eda-stds.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](http://www.eda-stds.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/bugform.txt>

[icm-bug@eda.org](mailto:icm-bug@eda-stds.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-stds.org/ibis/icm_bugs/)

[http://www.eda.org/ibis/icm\_bugs/icm\_bugform.txt](http://www.eda-stds.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-stds.org/ibis/bugs/s2ibis/bugs2i.txt)

[http://www.eda.org/ibis/bugs/s2ibis2/bugs2i2.txt](http://www.eda-stds.org/ibis/bugs/s2ibis2/bugs2i2.txt)

[http://www.eda.org/ibis/bugs/s2iplt/bugsplt.txt](http://www.eda-stds.org/ibis/bugs/s2iplt/bugsplt.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](http://www.eda-stds.org/ibis/directory.html)

Other trademarks, brands and names are the property of their respective owners.

**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

Interest categories associated with SAE ballot voting are:

* Users - Members that utilize electronic equipment to provide services to an end user.
* Producers - Members that supply electronic equipment.
* General Interest - Members are neither producers nor users. This category includes, but is not limited to, Government, regulatory agencies (state and federal), researchers, other organizations and associations, and/or consumers.