

**IBIS Open Forum Minutes**

Meeting Date: **November 15, 2017**

Meeting Location: **Taipei, Taiwan**

**VOTING MEMBERS AND 2017 PARTICIPANTS**

ANSYS Curtis Clark, Toru Watanabe, Baolong Li, Benson Wei\*

Applied Simulation Technology (Fred Balistreri)

Broadcom [Bob Miller], (Cathy Liu)

Cadence Design Systems Brad Brim, Sivaram Chillarige, Debabrata Das

Ambrish Varma, Kumar Keshavan, Ken Willis

Brad Griffin, Aileen Chen, Lanbing Chen

Guoyu Cui, Wei Dai, Zhiyu Guo, Henry He

Jinsong Hu, Liang Jiang, Skipper Liang\*

Ping Liu, Feng Miao, Zuli Qin, Haisan Wang

Hui Wang, Yitong Wen, Clark Wu, Janie Wu

Susan Wu, Benny Yan, Haidong Zhang

Alex Zhao, Zhangmin Zhong, Kent Ho\*, Angel Lai\*

Muse Shao\*, Candy Yu\*

Cisco Systems Lei (Jason) Liu, Cassie (Xu) Yan

CST Stefan Paret, Matthias Troescher, Burkhard Doliwa

Danilo Di Febo, Alexander Melkozerov

Ericsson Zilwan Mahmod, Guohua Wang, Amy X Zhang

GLOBALFOUNDRIES Steve Parker

Huawei Technologies Haiping Cao, Wei (Richard) Gu, Zhenxing Hu

Peng Huang, Hongxing Jiang, Longfang Lv

Luya Ma, Guangjiang Wang, Huichao Weng

Zhengrong Xu, Hang (Paul) Yan, Chen (Jeff) Yu

Xiaojun (Steve) Zhou, Zhengyi Zhu, Huajun Chen

Shengli Wang, Zen Wei

Huawei Technologies (Hisilicon) Fangxu Yang

IBM Luis Armenta, Adge Hawes, Greg Edlund

Infineon Technologies AG (Christian Sporrer)

Intel Corporation Michael Mirmak, Hsinho Wu, Eddie Frie

Gianni Signorini, Barry Grquinovic

Masashi Shimanouchi, Denis Chen\*, Jimmy Hsu\*

Cucumber Lin\*, Zoe Li\*, Thonas (Yiren) Su\*

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Keysight Technologies Radek Biernacki, Pegah Alavi, Fangyi Rao

Stephen Slater, Jian Yang, Heidi Barnes

Kuen Yew Lam\*

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Mentor, A Siemens Business Arpad Muranyi, Nitin Bhagwath, Praveen Anmula

(formerly Mentor Graphics) Fadi Deek, Raj Raghuram, Dmitry Smirnov

Bruce Yuan, Carlo Bleu, Chao Jiang, David Xu

Micron Technology Randy Wolff, Justin Butterfield, Jeff Shiba, Harry Shin

NXP (John Burnett)

Qualcomm Tim Michalka, Kevin Roselle, Irwin (Zhilong) Xue\*

Raytheon Joseph Aday

SiSoft Mike LaBonte\*, Walter Katz, Todd Westerhoff

Steve Silva

Synopsys Kevin Li, Ted Mido, John Ellis, Scott Wedge

Wonsae Sim, Xuefeng Chen, Jinghua Huang

Yijiang Huang, Deng Shi, Yuyang Wang

Teraspeed Labs Bob Ross

Xilinx (Raymond Anderson)

ZTE Corporation Rongxing Ban, Xinjian Chen, Fengling Gao

Tao Guo, Lili Wei, Yangye Yu, Shunlin Zhu

Zuken Ralf Bruening, Michael Schaeder, Alfonso Gambuzza

**OTHER PARTICIPANTS IN 2017**

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Amphenol Fred Shen, Holly Wang

ASR Microelectronics Lili Dia, Shulong Wu

ASRock Rack Eric Chien\*

ASUS Nick Huang\*, Bin-chyi Tseng, Andrew Huang\*

Aurora System Murong Lu, Jiaxin Sun

Avant Technology Jyam Huang\*, Chloe Yang\*

BasiCAE Kiki Li, Darcy Liu, July Tao, Lisa Wu

Brite Semiconductor Haonan Wang

Celestica Wilson Chen, Sophia Feng, Lurker Li

Weiqing Liiu, Vincent Wen

Continental AG Stefanie Schatt

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Extreme Networks Bob Haller

Flextronics Renjun Sun

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Independent Dian Yang, Lawrence Der

Inspur Technologies Josh Chen\*, Dane Huang\*, Nieves Lee\*, Ian Yu\*

Institute for Information Industry Joseph Lang\*

Inventec Ian Chen\*, Ellen Tseng\*

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Minlun Lan\*, George Lee\*, Allen Ye\*

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Group Xiao Lei Luo, Canghai Tang

Shinewave Nike Yang\*

Signal Metrics Ron Olisar

SMICS Sheral (Xuejiao) Qi

SPISim (Peace Giant Corp.) Wei-hsing Huang\*, Walter Huang\*

Spreadtrum Communications Junyong Deng, Ganyue Wang, Shiqing Si

Stanford University Tom Lee

STMicroelectronics Fabio Brina, Olivier Bayet

Tatung Technology Barry Chen\*, Daniel Chen\*

Teledyne Lecroy Facun Li, Yifeng Wu

TopBrain Ye Li

Toshiba Yasuki Torigoshi

U-Creative Amber Wu

Université Blaise Pascal Mohamed Toure

Université de Bretagne Occidentale Mihai Telescu

VIA Labs Shengyuan Lee\*

VIA Technologies Terence Hsieh\*, Justin Hsu\*

Winbond Yumin Hou\*, Albert Lee\*

Xpeedic Tuhui Gui

Yi Chuan Technology Wei Ming Lu

Zhaoxin Liam Li, Eddrick Wang

Zhejiang Uniview Technologies Busen Cai, Jilun Fang

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

November 17, 2017 Tokyo IBIS Summit – no teleconference

December 1, 2017 624 999 876 IBISfriday11

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

<http://tinyurl.com/zeulerr>

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.

NOTE: "AR" = Action Required.

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**OFFICIAL OPENING**

The Asian IBIS Summit took place on Wednesday, November 15, 2017 at the Sherwood Hotel in Taipei. About 62 people representing 28 organizations attended.

The notes below capture some of the content and discussions. The meeting presentations and other documents are available at:

<http://www.ibis.org/summits/nov17b/>

Mike LaBonte welcomed participants on behalf of the IBIS Open Forum and convened the meeting.

Mike continued by thanking all the co-sponsors including IO Methodology, Peace Giant Company (SPISim), and Synopsys.

**IBIS UPDATE**

Mike LaBonte (SiSoft, USA)

Mike LaBonte detailed the activities of the IBIS Open Forum over the past year. He showed a possible timeline for the passage of IBIS 7.0, as well as the status of all current BIRDs that may or may not be part of IBIS 7.0. Mike gave a brief summary of the changes in three BIRDs likely to become part of IBIS 7.0.

A comment was made about the lack of defined message protocols for BIRD147, that they should be defined because most PCIe analyses involve a TX and RX from different vendors. Mike responded that the protocols would be posted on the IBIS website, and this would allow for quicker implementation than if we were to wait for a new IBIS specification.

**IBIS INTERCONNECT MODELING USING IBIS-ISS AND TOUCHSTONE**

Michael Mirmak (Intel Corporation, USA)

[Presented by Mike LaBonte (SiSoft, USA)]

Mike LaBonte presented on behalf of Michael Mirmak. The concepts found in BIRD189.x were summarized. The new format is an improvement over existing IBIS [Define Package Model] in several ways, allowing for both cascaded model sections as well as coupling in any combination. The Touchstone format and the ability to separately model buffer to pad and pad to pin connections would be helpful for the high speed signals used today. The addition of die pads for rails allowed for circuit topologies suitable for modeling the power and ground rails in chips.

**LEVERAGING IBIS CAPABILITIES FOR MULTI-GIGABIT INTERFACES**

Ken Willis (Cadence Design Systems, USA)

[Presented by Skipper Liang (Cadence Design Systems, ROC)]

Skipper Liang noted that the presentation related to the EDI CON paper “Signal Integrity Methodology for Double-Digit Multi-Gigabit Interfaces”. Use of Spice [External Model]s makes it easy to write simple parameterized Spice subcircuits for I/O buffers when IBIS availability does not align with a project schedule. The EDA tool user can select parameter values from a GUI using the [External Model] “Parameters” and “Converter\_Parameters” syntax.

Skipper described the typical modules of an Rx AMI model including gain, CTLE and DFE. These modules typically adapt at different rates, and the initial modules like gain and CTLE usually adapt more slowly than the DFE. He showed how adjusting the adaptation algorithms of the AMI model led to better adaptation and a significant difference in final eye height. Skipper showed details of the backchannel flow from BIRD147. He went on to show the application of IBIS-AMI modeling and simulation techniques to DDR4/5. Cadence developed an IBIS-AMI model for a DDR4 controller that included equalization. He showed correlation between an IBIS-AMI model-based channel simulation and a transistor-level circuit simulation.

**COMPARISON OF TIME DOMAIN AND STATISTICAL IBIS-AMI ANALYSES**

Mike LaBonte (SiSoft, USA)

Mike LaBonte noted that a dual IBIS-AMI model has an AMI file with GetWave\_Exists set to true and Init\_Returns\_Impulse set to true. This is the best option for running both time domain and statistical analysis. Mike reviewed some fundamentals of channel simulation including inputs and outputs of time-domain and statistical simulations, channel impairments, step response and pulse response analysis, eye height prediction from pulse response cursor analysis, and methods for all the ISI in a given channel. He then discussed jitter and noise impairments and equalization methods. He concluded that IBIS-AMI time domain simulation with AMI\_GetWave can model non-linear effects such as DFE and saturation, but it can be impossible to simulate enough bits to prove the low BER requirements of some technologies. IBIS-AMI statistical simulation can quickly evaluate low BER, but it cannot see time-variant effects such as DFE and saturation. So, dual IBIS-AMI models are required.

**CHARACTERIZING AND MODELING OF A LINEAR CTE**

Skipper Liang (Cadence Design Systems, ROC)

Skipper Liang noted that when creating an IBIS-AMI model for an RX, it is necessary to divide the buffer between the analog part and the algorithmic part. He showed a method in which modelers no longer need to model the RX IBIS (analog part) model. A dummy IBIS model is used, and the buffer characteristics are put in the AMI model. The CTE is modeled using a step response time domain characterization. The method is only valid when the equalizer is purely linear.

**USING DATA FILES FOR IBIS-AMI MODELS**

Lance Wang (IO Methodology, USA)

Lance Wang noted that creating IBIS-AMI models can require making executables for many platforms and OS’s. He presented the concept of creating a single DLL/SO file that references external data files, allowing reuse of code for different transceivers by only modifying the data file. If using data files, the DLL/SO contains AMI standard functions, data processing functions and data file processing functions that might include decryption of the data file. The data file can contain code, data, parameters, and it could be encrypted. With this approach, the DLL/SO file could be developed by professional programmers and used for many different data files. The data file can then be created by designers or modelers and would not require compilation. A test case was shown that pointed to the data file through a Model\_Specific parameter.

**IBIS-AMI MODELING USING SCRIPTS AND SPICE MODELS**

Wei-hsing Huang (SPISim, USA)

Wei-hsing Huang investigated the creation of IBIS-AMI models using scripting languages and existing SPICE models. The flow could reduce AMI modeling time and serve as an intermediate step towards full C/C++ implementation. Considerations include performance and the redistribution and use of models that could rely on an external SPICE simulator.

**CLOSING REMARKS**

Mike LaBonte thanked the co-sponsors, presenters and attendees for their participation and support.

**NEXT MEETING**

The next IBIS Open Forum teleconference meeting will be held December 1, 2017. The following IBIS Open Forum teleconference meeting is tentatively scheduled on December 15, 2017.

The Asian IBIS Summit in Tokyo will be held November 17, 2017. No teleconference will be available for the Summit meeting.

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**NOTES**

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This meeting was conducted in accordance with ANSI guidance.

All inquiries may be sent to [info@ibis.org](mailto:info@ibis.org). Examples of inquiries are:

* To obtain general information about IBIS.
* To ask specific questions for individual response.
* To subscribe to the official [ibis@freelists.org](mailto:ibis@freelists.org) and/or [ibis-users@freelists.org](mailto:ibis-users@freelists.org) email lists (formerly [ibis@eda.org](mailto:ibis@eda.org) and [ibis-users@eda.org](mailto:ibis-users@eda.org)).
* To subscribe to one of the task group email lists: [ibis-macro@freelists.org](mailto:ibis-macro@freelists.org), [ibis-interconn@freelists.org](mailto:ibis-interconn@freelists.org), or [ibis-quality@freelists.org](mailto:ibis-quality@freelists.org).
* To inquire about joining the IBIS Open Forum as a voting Member.
* To purchase a license for the IBIS parser source code.
* To report bugs or request enhancements to the free software tools: ibischk6, tschk2, icmchk1, s2ibis, s2ibis2 and s2iplt.

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

<http://www.ibis.org/bugs/ibischk/>   
[http://www.ibis.org/ bugs/ibischk/bugform.txt](http://www.ibis.org/%20bugs/ibischk/bugform.txt)

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

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

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

<http://www.ibis.org/bugs/icmchk/>   
<http://www.ibis.org/bugs/icmchk/icm_bugform.txt>

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

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

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

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

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

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

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**SAE STANDARDS BALLOT VOTING STATUS**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Organization** | **Interest Category** | **Standards Ballot Voting Status** | **October 18, 2017** | **October 27, 2017** | **November 13, 2017** | **November 15, 2017** |
| ANSYS | User | Active | X | X | - | X |
| Applied Simulation Technology | User | Inactive | - | - | - | - |
| Broadcom Ltd. | Producer | Inactive | - | - | - | - |
| Cadence Design Systems | User | Active | - | - | X | X |
| Cisco Systems | User | Inactive | - | - | X | - |
| CST | User | Inactive | - | - | - | - |
| Ericsson | Producer | Inactive | - | - | X | - |
| GLOBALFOUNDRIES | Producer | Inactive | - | X | - | - |
| Huawei Technologies | Producer | Inactive | - | - | X | - |
| IBM | Producer | Inactive | - | - | - | - |
| Infineon Technologies AG | Producer | Inactive | - | X | - | - |
| Intel Corp. | Producer | Active | X | X | - | X |
| IO Methodology | User | Active | - | X | X | X |
| Keysight Technologies | User | Active | X | X | - | X |
| Maxim Integrated | Producer | Inactive | - | - | - | - |
| Mentor, A Siemens Business | User | Active | X | X | X | - |
| Micron Technology | Producer | Inactive | - | X | - | - |
| NXP | Producer | Inactive | - | - | - | - |
| Qualcomm | Producer | Inactive | X | - | - | X |
| Raytheon | User | Inactive | - | - | - | - |
| SiSoft | User | Active | - | X | X | X |
| Synopsys | User | Active | X | X | X | - |
| Teraspeed Labs | General Interest | Inactive | X | X | - | - |
| Xilinx | Producer | Inactive | - | - | - | - |
| ZTE Corp. | User | Inactive | - | - | X | - |
| Zuken | User | Inactive | - | - | - | - |

Criteria for SAE 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 standards 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.