

IBIS Open Forum Minutes

Meeting Date: October 18, 2017 Meeting Location: EPEPS 2017 IBIS Summit, San Jose, California, USA

VOTING MEMBERS AND 2017 PARTICIPANTS

ANSYS	Curtis Clark, Toru Watanabe, Baolong Li*
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
Cisco Systems	(Bidyut Sen)
CST	Stefan Paret, Matthias Troescher, Burkhard Doliwa
	Danilo Di Febo, Alexander Melkozerov
Ericsson	Zilwan Mahmod
GLOBALFOUNDRIES	Steve Parker
Huawei Technologies	(Jinjun Li)
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*
IO Methodology	Lance Wang
Keysight Technologies	Radek Biernacki, Pegah Alavi*, Fangyi Rao
	Stephen Slater*, Jian Yang, Heidi Barnes*
Maxim Integrated	Joe Engert, Don Greer, Yan Liang, Hock Seow
Mentor, A Siemens Business	Arpad Muranyi, Nitin Bhagwath, Praveen Anmula
(formerly Mentor Graphics)	Fadi Deek, Raj Raghuram*, Dmitry Smirnov
	Bruce Yuan, Carlo Bleu
Micron Technology	Randy Wolff, Justin Butterfield, Jeff Shiba, Harry Shin
NXP	(John Burnett)
Qualcomm	Tim Michalka, Kevin Roselle*
Raytheon	Joseph Aday
SiSoft	Mike LaBonte, Walter Katz, Todd Westerhoff
	Steve Silva
Synopsys	Kevin Li, Ted Mido*, John Ellis, Scott Wedge
	Wonsae Sim*
Teraspeed Labs	Bob Ross*
Xilinx	(Raymond Anderson)
ZTE Corporation	(Shunlin Zhu)
Zuken	Ralf Bruening, Michael Schaeder, Alfonso Gambuzza

OTHER PARTICIPANTS IN 2017

Accton	Raul Lozano
ASUS	Nick Huang, Bin-chyi Tseng
Continental AG	Stefanie Schatt
eASIC	David Banas
Extreme Networks	Bob Haller
Ghent University	Paolo Manfredi
Hamburg University of Technology	Torsten Revschel, Torsen Wendt
IdemWorks	Michelangelo Bandinu
Ilia State University	Nana Dikhaminjia*
Independent	Dian Yang, Lawrence Der
John Baprawski, Inc.	John Baprawski
KEI Systems	Shinichi Maeda
Lattice Semiconductor	Maryam Shahbazi, Dinh Tran
Leading Edge	Pietro Vergine
Lexington Consulting	Mike Barg
Missouri Science and Technology	Giorgi Maghlakelidze*
Politecnico di Torino	Claudio Siviero, Stefano Grivet-Talocia, Igor Stievano
SAE International	(Thomas Munns)
Samsung	Jung Hwan Choi*
Signal Metrics	Ron Olisar
SPISim	Wei-hsing Huang*
Stanford University	Tom Lee*
STMicroelectronics	Fabio Brina, Olivier Bayet
Toshiba	Yasuki Torigoshi
Université Blaise Pascal	Mohamed Toure
Université de Bretagne Occidentale	Mihai Telescu

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
October 27, 2017	624 999 876	IBISfriday11
November 13, 2017	Asian IBIS Summit (Shanghai)	 no teleconference
November 15, 2017	Asian IBIS Summit (Taipei) - no	o teleconference
November 17, 2017	Asian IBIS Summit (Tokyo) - no	o teleconference

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.

OFFICIAL OPENING

The IBIS Open Forum Summit was held in the DoubleTree Hilton Hotel after the EPEPS 2017 workshop. About 16 people representing 12 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/oct17/

Bob Ross welcomed everyone to the Summit, opening the meeting at 1:15 p.m. He thanked the sponsors including EPEPS, Keysight Technologies, and Synopsys. Bob noted that Keysight provided the projector in spite of fire-related difficulties at their Santa Rosa, California location. Everyone in the room introduced themselves.

KEYNOTE SPEECH GO BIG OR GO HOME: THE FIRST TRANSATLANTIC TELEGRAPH CABLE AND THE BIRTH OF ELECTRICAL ENGINEERING

Tom Lee (Stanford University)

Bob Ross introduced Tom Lee by displaying his biography. Tom joined Stanford in 1994. He has extensive academic accomplishments, several awards, and significant industrial experience. Tom holds over 60 patents and has authored textbooks. He owns many oscilloscopes and electronic components.

Tom's biography and abstract are uploaded. Per Tom's request, the presentation itself is not publicly distributed because it is used in many other settings and for student orientation. Tom's abstract plus some additional details are presented here.

"Abstract: Electrical engineers are the children of a failure so traumatic that we don't even talk about it. American paper magnate Cyrus West Field wanted to span the Atlantic in the 1850s with a telegraph cable; it was the Victorian era's equivalent of shooting for the moon. Amplifiers would not exist for another half-century, so success would require mastery of a number of complex technical disciplines. Regrettably, the project's technical head was a medical doctor. A British board of inquiry convened to assess the resulting failures noted that the electrical arts lacked even a basic vocabulary to describe the failure. William Thomson was eventually named the new head of the project, and final success followed in 1866. The volt, ohm and ampere were formally defined shortly thereafter and the profession of electrical engineering was born. Thomson -- arguably the first professional electrical engineer -- became Lord Kelvin, and EEs have been busy making mischief ever since."

Tom added many interesting details. Based on Moore's law, many transistors now support five million cell phones sold daily. This contributes to producing 100 TPA every year (100 transistors per ant on earth annually). The story of the transatlantic cable reveals that the secret to Greatness is a function of Money, Ignorance, Luck, and Craziness, as expressed in the formula $G = f\{M,I,L,C\}$. In the path to greatness, Murphy's law also seems to prevail. Luck may also prevail as new technologies emerge at convenient times.

One technology was the discovery of Gutta-Percha, a natural substance from trees mainly in Singapore/Malaysia. It is a thermoplastic, chemically stable, and has tolerance of water. This was useful to protect the cable from corrosion. Another key technology was the highly sensitive mirror galvanometer by Lord Kelvin to detect small voltages. Magnets canceled out the earth's magnetic field.

The transmission data rate target for the transatlantic cable was 1-2 words per minute, but the first cable in 1857/1858 achieved only 0.1 words per minute. Many problems arose, and the cable went silent after 23 days. It took 16 hours to transmit a 98-word message perhaps with the operator using context to fill in the somewhat garbled transmission. Perhaps this was a first application of what would be done today by artificial intelligence. After much debate, a new, heavier cable was proposed. However, it required a five times bigger ship than had currently existed to lay it. As luck would have it, a new class of ships were being constructed to hold enough fuel to travel non-stop from England to Australia.

The overall cable properties were length of 3000 nautical miles, series resistance of 8 kohms, shunt capacitance of 740 uF, and shunt resistance of 200 kohms. This provided an RC time constant of 6 seconds. Five words per minute could be transmitted, exceeding the original target. The cable snapped several times before finally being placed in service in 1866. By 1891, more cables formed a global communications network.

Many legacies emerged from Cyrus West Field's initial money, ignorance, luck and craziness. They include the unit of resistance, the electrical engineering profession emerging as the Institution of Electrical Engineers, and several EE degree programs at universities in the 1880s. The cable descendants include networks that contribute to 250,000 texts per second.

The full story of successes and failures illustrates all aspects of the bottom line: "May you always have as much MILC as you need."

Bob asked what the electrical transmission line characteristics were, and Tom responded that it had characteristics similar to RG-58.

IBIS UPDATE

Mike LaBonte (SiSoft) [Presented by Bob Ross (Teraspeed Labs)]

Bob Ross showed the 26 current members of IBIS, the IBIS officers, and he detailed the many IBIS Open Forum and task group meetings and Summits. The parent organization of the IBIS Open Forum is the SAE Industry Technologies Consortia. IBIS version 7.0 is under

development, and it has been just over two years since version 6.1 was ratified. He discussed a possible timeline for release of IBIS version 7.0 and a list of BIRDs to be included and excluded. He gave an overview of some prominent BIRDs targeted for inclusion in IBIS version 7.0 including BIRD147 for backchannel support, BIRD158 for AMI Touchstone analog buffer model support, BIRD188 for expanded Rx noise support for AMI, and BIRD189 for interconnect modeling using IBIS-ISS and Touchstone.

Nana Dikhaminjia asked about two different back-channel proposals that had been discussed in the past. Pegah Alavi responded that the proposals have been merged into the current one. Bob added that the combined proposal is much simpler and defines only five new parameters for IBIS-AMI.

IBIS-AMI MODELING USING SCRIPTS AND SPICE MODELS

Wei-hsing Huang (SPISim)

Wei-hsing provided a motivation and IBIS-AMI background for using scripts and existing SPICE models to overcome some existing barriers. Python and other scripting languages can be used. Several open-source SPICE simulators that support API/shared libraries are available. Wei-hsing showed development flows using scripts. He also showed a development flow with SPICE that can be used to dynamically generate piece-wise linear (PWL) inputs based on a high-Z assumption.

Ted Mido and others asked whether the models could be used in commercial EDA tools. Weihsing responded yes, but he added that these models might be used for initial quick prototyping. The models are created assuming LTI behavior.

EQUALIZATIONS FOR MULTI-LEVEL SIGNAL

Nana Dikhaminjia, Ilia State University

Nana Dikhaminjia presented a fast, improved optimization algorithm for MMSE (minimum mean squared error) to recover signals using equalizers such as FFE (feed forward equalizer), CTE (continuous time equalizer), and DFE (decision feedback equalizer). She displayed the equations for DFE. For best results, the desired training signal should be normalized to the maximum of the un-equalized signal. The optimization algorithm will always converge. Nana showed the equations and displayed results for NRZ improvements versus several different parameters such as eye-opening, data rates, number of taps, loss, and FFE-DFE combination.

Nana also presented some formulas and results for PAM-4 improvement with DFE. She also showed PAM-4 de-emphasis, PAM-4 equalization of a signal by bit and by symbol, and showed some comparisons. She provided a number of conclusions. One conclusion is that when the signal is not heavily emphasized, the eye-height is significantly improved. But a limitation is that the compensation value is proportional to the C1 tap strength, causing PAM-4 signals to overshoot and to close the eye by mixing with each other.

In the discussion, Nana concluded that the optimization approach can be used to find and produce better tap coefficients.

INTERCONNECT MODELING USING IBIS-ISS AND TOUCHSTONE

Michael Mirmak (Intel Corporation) [Presented by Bob Ross (Teraspeed Labs)]

Bob Ross stated that BIRD189.x by the Interconnect Task Group is available for review. The BIRD is intended for IBIS Version 7.0, and its purpose is to improve package and on-die interconnect models by supporting IBIS-ISS and Touchstone models. This includes models of both I/O and supply connections. An optional die pad interface between pins and buffers is introduced. A one-to-one path connection is assumed for I/Os. Supply rails can have multiple terminals and be merged at the various interfaces.

Bob showed some details of new keywords and subparameters as well as syntax examples. Some changes include [Interconnect Model Set Group] and the subparameter File_TS0 (along with File_TS for declaring a global ground or an explicit rail as a Touchstone reference. The rules have changed for unused ports (or nodes in IBIS-ISS). For IBIS-ISS, unused nodes are illegal. There is still discussion concerning the options of Open or Reference for terminating unused ports in Touchstone files. More revisions are in progress from the Interconnect Task Group.

A question was asked if Touchstone references for each port can be supported. Bob responded that this can be supported by the IBIS-ISS format with an S model.

INTERCONNECT MODELS: NEW FEATURES FOR RAIL CONNECTIONS

Bob Ross (Teraspeed Labs)

Bob Ross mentioned that the main point of this presentation is to introduce some features that are planned for Version 7.0 that have not been discussed. They involve extended ways to define bus_label entries used in [Pin Mapping] and for terminals in the BIRD189.x.

Existing [Pin Mapping] support requires that all rail (POWER, GND) model pin_names be listed. BIRD182 gives meaning to the [Pin] signal_name entry for rails, and a missing pin_name entry in [Pin Mapping] still can provide a bus_label = signal_name entry for that missing pin_name. Pending BIRD189 also explicitly defines with a new [Bus Label] keyword a bus_label entry for a given signal_name value. Finally, the new [Die Supply Pads] keyword, used to define pad_names on a one-to-many, or many-to-one basis, associates pad_names with signal_names and with bus_labels. The later association can provide another way to define bus_label entries that are terminals in interconnect models, but not necessarily used in [Pin Mapping].

Bob summarized these features by showing a simplified example that could combine all four ways to enter bus_labels. Any combination of these methods can be used.

CLOSING REMARKS

Bob Ross again thanked the sponsors EPEPS, Keysight Technologies, and Synopsys and the presenters and everyone for attending.

The meeting concluded at approximately 5:15 PM.

NEXT MEETING

The next IBIS Open Forum teleconference meeting is scheduled for October 27, 2017. A vote on holding an IBIS Summit meeting at DesignCon 2018 is scheduled. Votes on BIRD158.6 and BIRD161.1 are also scheduled. The following IBIS Open Forum teleconference meeting is tentatively scheduled on December 1, 2017.

The Asian IBIS Summit in Shanghai will be held November 13, 2017. The Asian IBIS Summit in Taipei will be held November 15, 2017. The Asian IBIS Summit in Tokyo will be held November 17, 2017. No teleconferences will be available for the Summit meetings.

NOTES

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This meeting was conducted in accordance with ANSI guidance.

All inquiries may be sent to 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 <u>ibis@freelists.org</u> and/or <u>ibis-users@freelists.org</u> email lists (formerly <u>ibis@eda.org</u> and <u>ibis-users@eda.org</u>).
- To subscribe to one of the task group email lists: <u>ibis-macro@freelists.org</u>, <u>ibis-interconn@freelists.org</u>, or <u>ibis-quality@freelists.org</u>.
- 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

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

		Standards Ballot				
	Interest	Voting	September	September	October 6,	October 18,
Organization	Category	Status	13, 2017	15, 2017	2017	2017
ANSYS	User	Active	Х	-	Х	Х
Applied Simulation Technology	User	Inactive	-	-	-	-
Broadcom Ltd.	Producer	Inactive	-	-	Х	-
Cadence Design Systems	User	Active	Х	-	Х	-
Cisco Systems	User	Inactive	-	-	-	-
CST	User	Inactive	-	-	Х	-
Ericsson	Producer	Inactive	-	-	-	-
GLOBALFOUNDRIES	Producer	Inactive	-	-	Х	-
Huawei Technologies	Producer	Inactive	-	-	-	-
IBM	Producer	Inactive	-	-	Х	-
Infineon Technologies AG	Producer	Inactive	-	-	Х	-
Intel Corp.	Producer	Active	-	Х	Х	Х
IO Methodology	User	Active	Х	Х	Х	-
Keysight Technologies	User	Active	-	Х	Х	Х
Maxim Integrated	Producer	Inactive	-	-	-	-
Mentor, A Siemens Business	User	Active	-	Х	Х	Х
Micron Technology	Producer	Active	Х	Х	Х	-
NXP	Producer	Inactive	-	-	Х	-
Qualcomm	Producer	Inactive	-	-	-	Х
Raytheon	User	Inactive	-	-	Х	-
SiSoft	User	Active	Х	Х	Х	-
Synopsys	User	Active	-	Х	Х	Х
Teraspeed Labs	General Interest	Active	-	Х	Х	Х
Xilinx	Producer	Inactive	-	-	Х	-
ZTE	User	Inactive	-	-	-	-
Zuken	User	Inactive	-	-	Х	-

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.