



IBIS Open Forum Minutes

Meeting Date: **April 24, 2020**

Meeting Location: **Teleconference**

VOTING MEMBERS AND 2020 PARTICIPANTS

ANSYS	Curtis Clark*, Wei-hsing Huang, Marko Marin Shai Sayfan-Altman, Zilwan Mahmod
Applied Simulation Technology	(Fred Balistreri)
Broadcom	James Church
Cadence Design Systems	Zhen Mu, Ambrish Varma, Jared James Kumar Keshavan, Ken Willis
Cisco Systems	Stephen Searce, Hong Wu
Dassault Systemes (CST)	Stefan Paret
Ericsson	Anders Ekholm, Sungjoo Yu, Thomas Ahlstrom
Google	Zhiping Yang*, Shuai Jin, Zhenxue Xu
Huawei Technologies	(Hang (Paul) Yan)
IBM	Michael Cohen*
Infineon Technologies AG	(Christian Sporrer)
Instituto de Telecomunicações	(Abdelgader Abdalla)
Intel Corporation	Hsinho Wu*, Michael Mirmak*, Adrien Auge Fernando Mendoza*, Taeyoung Kim, Wendem Beyene Oleg Mikulchenko, Nhan Phan, Ifiok Umoh Subas Bastola
Keysight Technologies	Radek Biernacki*, Hee-Soo Lee, Todd Bermensolo Graham Riley, Pegah Alavi, Fangyi Rao Stephen Slater
Marvell	Steve Parker*, Johann Nittmann
Maxim Integrated	Joe Engert, Charles Ganai, Dzung Tran, Yan Liang
Mentor, A Siemens Business	Arpad Muranyi*, Raj Raghuram, Todd Westerhoff Weston Beal
Micron Technology	Randy Wolff*, Justin Butterfield
NXP	John Burnett
SerDesDesign.com	John Baprawski
SiSoft (MathWorks)	Mike LaBonte*, Walter Katz*, Graham Kus
Synopsys	Ted Mido*, Andy Tai
Teraspeed Labs	Bob Ross*
Xilinx	Ravindra Gali
ZTE Corporation	(Shunlin Zhu)
Zuken	Michael Schäder, Kazunari Koga
Zuken USA	Lance Wang*

OTHER PARTICIPANTS IN 2020

Accton	Tariq Abou-Jeyab
Achronix Semiconductor	Hansel Dsilva
Apollo Giken Co.	Satoshi Endo
Kandou Bus	Sherman Chen
KEI Systems	Shinichi Maeda
Kioxia Corporation	Yasuo Otsuka
OmniVision	Sirius Tsang
Qualcomm	Kevin Roselle, Sunil Gupta
Renesas	Genichi Tanaka
RITA Electronics	Takahide Nozaki
SAE ITC	Jose Godoy
Samsung	Wonsuk Choi
San Jose State University	Vincent Tam
Seagate	Preetesh Rathod, Alex Tain, Karthik Chandrasekar Emmanuel Atta
Signal Metrics	Ron Olisar
Silvaco Japan Co.	Yoshiharu Furui
SK Hynix Memory Solutions	Jongchul Shin, Alex Lee, James Yu
Socionext	Matsumura Motoaki, Shinichiro Ikeda Takafumi Shimada [Wei-hsing Huang]
SPISim	Dongmei Han, Edward Pulscher, Sheri Zhuang
Teradyne	Tomoo Tashiro, Paul Carlin, Tao Wang

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 15, 2020	627 261 744	Friday1

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

<https://tinyurl.com/IBISfriday-new>

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.

INTRODUCTIONS AND MEETING QUORUM

Curtis Clark declared that a quorum was reached.

CALL FOR PATENTS

Randy Wolff called for declaration of any patents or pending patents related to the IBIS, IBIS-ISS, ICM, or Touchstone 2.0 specifications. No patents were declared.

REVIEW OF MINUTES AND ARS

Randy Wolff called for comments on the minutes of the April 3, 2020 IBIS Open Forum teleconference. Randy noted that an extra 'f' character had mistakenly appeared at the end of Hong Wu's name in the Participants section of the last two sets of minutes. Curtis Clark said Randy had informed him, and this would be corrected in the next set of minutes. Mike LaBonte moved to approve the minutes with the noted correction. Radek Biernacki seconded the motion. There were no objections

Randy reviewed ARs from the previous meeting.

1. Randy to provide an update on the JEDEC JESD204C.1 request to use text from the IBIS specification and the legal discussion with SAE ITC [AR].
Randy reported that he had queried SAE-ITC legal for the status of their response to the questions from the head of JEDEC about the SAE ITC copyright agreement. They replied that they had made a few changes and responded to JEDEC. Randy said that they are now waiting for a reply from JEDEC, and that he hoped this would now move forward. Randy said that he had forwarded the draft agreement to the rest of the IBIS Board and would provide future updates as required.
2. Steve Parker to update the Japan and DesignCon IBIS Summits on the Upcoming Events page [AR].
Steve reported that this had been done. The tentative date for the Tokyo summit had been posted, and the tentative details of the DesignCon summit had been updated.
3. Randy to send BIRD198.1 to Steve Parker for posting [AR].
Randy reported that this had been done.
4. Randy to send an email to the Open Forum announcing the BIRD201 vote [AR].
Randy reported that this had been done.
5. Randy to send an email to the Open Forum announcing the BIRD203 vote [AR].
Randy reported that this had been done.
6. Bob Ross to update BUG211 status on the webpage [AR].
Bob reported that this had been done.

ANNOUNCEMENTS, CALL FOR ADDITIONAL AGENDA ITEMS

Randy Wolff noted that BIRD204 had been submitted earlier in the week. BIRD204 is introduced and discussed in the Technical Discussion section of these minutes.

Randy noted that he had updated some IBIS 7.0 interconnect model syntax examples that are freely available. This topic is discussed in the New Technical Issues section of these minutes.

MEMBERSHIP STATUS AND TREASURER'S REPORT

Bob Ross reported that the financial books for 2019 had been adjusted back downward by \$3,000, relative to what was reported at the last meeting, because the receipt for one parser payment was issued in 2020 even though the payment had been received in 2019. We had \$22,227 cash flow for 2019 and an adjusted balance of \$23,727 for 2019.

We now have 26 members, and Bob noted that he was still working with a potential new member for a half-year membership. Thus far, 21 organizations have paid for 2020 membership (20 renewals, and one new member), and Bob expected the remaining five to come in soon. Existing members will carry over through May of 2020, and their membership will end then unless they renew for 2020. We have \$17,878 cash flow for 2020 and an \$18,228 adjusted balance for 2020. These numbers reflect a recently received membership payment and a payment for sponsorship of the Asian IBIS Summit at Shanghai. Bob said that one company had inquired about purchasing ibischk7 and tschk2.

Zhiping Yang asked if IBIS offered any reduced rate university memberships. Bob said that we currently don't have any special memberships rates for universities, but several had asked in the past. Randy Wolff said it was something the Board could discuss [AR]. Bob said it would require a change of our bylaws. Zhiping said he wasn't proposing a change, but he was trying to figure out what he could do to encourage participation from a university with which he was collaborating. Bob said they were always welcome to participate even if they didn't become a member. Mike LaBonte noted that a half-year membership is available if the university wants a one-time initial membership starting at mid-year.

WEBSITE ADMINISTRATION

Steve Parker reported that the website was up to date with respect to ATM, Interconnect, and Quality task group minutes and documents. Event updates had been posted, and BIRD198.1 and BIRD204 had been posted. Steve said the new Jenkins based automation scripts were working well. He said he had added one for uploading files to the ATM work archives and used it to catch up on the backlog of documents. He planned to create a script for Interconnect task group work files next and was considering one for BIRDS. Steve said he had one outstanding request from Mike LaBonte for a webpage for tschk2.

Randy Wolff commented that task group chairs should let Steve know what things need to be posted. Mike LaBonte, former webmaster, said it's very helpful to let the webmaster know what the titles of any documents should be. Steve concurred and said he gets many versions of files with the same name.

MAILING LIST ADMINISTRATION

Mike LaBonte reported that mailing lists were operating smoothly.

LIBRARY UPDATE

No update.

INTERNATIONAL/EXTERNAL ACTIVITIES

- Conferences

24th IEEE Workshop on Signal and Power Integrity (SPI 2020, May 17-20, Cologne, Germany)
Bob Ross noted that this had been officially postponed until 2021, and Steve Parker had removed this year's SPI Summit from the Upcoming Events page.

<https://spi2020.uni-siegen.de/>

2020 IEEE International Symposium on EMC + SIPI (July 27-31, Reno, NV)

Bob Ross noted that this had not been postponed, and Zhiping Yang would give an update in the Summit Planning section.

<https://www.emc2020.emcss.org/>

- Press Update

None.

- Related standards

IEC 63055/IEEE 2401, JEITA "LPB"

Michael Mirmak said this had been approved and is available. Until a new revision or draft is necessary, there will be nothing new to report. DASC continues to meet monthly, but there is not much of interest to IBIS community at the moment.

Zhiping Yang asked how IBIS works with IEEE on standards in general. He said there had been some discussion within the IEEE EMC Society on a power integrity standard. He had proposed that IBIS might be the right format for them to use. He thought that if IBIS could collaborate with IEEE EMC it would be better than them setting up a new IEEE standard. He asked how IEEE and IBIS could collaborate on this. Michael said the fundamental issue with IEEE is typically just awareness of IBIS. IBIS may be outside of the many IEEE members' normal familiarity. He said most of the awareness and strongest ties to IBIS come from IEEE DASC (dasc.org). They are a group within the Computer Society of IEEE and the IEEE Standards Association. They focus on EDA standards, and VHDL, Verilog, and others are handled by them. They are very much aware of IBIS and would like us to join IEEE. Their standards interact indirectly with IBIS. They don't standardize IBIS, but they standardize things IBIS may include or point to. IEEE 2401 is similar, but in the opposite direction. It's an LSI-Package-Board specification that may point to IBIS and or Touchstone.

Michael suggested that he and Zhiping set up a conversation with Stan Krolkoski, the DASC chair. They could discuss the power integrity project and the possibility of the IEEE standardizing a particular version of IBIS.

SUMMIT PLANNING AND STATUS

- IEEE EMC + SIPI Symposium (July 27-31, Reno, NV)

Bob Ross noted that a slot has been reserved for us on Friday, July 31st in the afternoon. It will be provided at no cost to us and includes the room, AV equipment, and light refreshments. The primary interest here is introducing IBIS to a new audience. Details are still uncertain because of travel restrictions. Bob said our backup plan is to host the meeting as a teleconference. Zhiping Yang said the organizers will probably decide at the end of May whether to continue, defer, or host entirely online.

Zhiping asked about IBIS interest in attending next year's conferences (May 3 - May 7, 2021, Raleigh, NC and July 30 - August 6, 2021, Glasgow, Scotland). He said the organizers for Raleigh were interested in reserving a full day for IBIS on May 7, and the schedule on the last day is often light so we could get good attendance. He also reported that there is strong interest from the Glasgow organizers. Randy Wolff asked about other scheduling details such as when the call for papers will go out. Zhiping to email Bob and Randy with the details of both conferences, so IBIS can begin to consider whether to hold summits [AR]. Bob acknowledged that we were grateful to have IEEE EMC invite IBIS to the meetings and allow us to host any summits based on IBIS rules (free and open to anyone).

QUALITY TASK GROUP

Mike LaBonte reported that the group is meeting on Tuesdays at 8:00 a.m. PT. The group continues to focus on ibischk. Mike reported that the group had completed work on BUG210, which was filed because of confusing error messages produced about "orphan" keywords. He said the group was looking into updating the tschk2 licensing agreement to reflect the fact that we are part of SAE-ITC. This was prompted by the purchase inquiry Bob Ross noted in the Treasurer's Report.

The Quality task group checklist and other documentation can be found at:

http://www.ibis.org/quality_wip/

ADVANCED TECHNOLOGY MODELING TASK GROUP

Arpad Muranyi reported that the group meets on Tuesdays at 12:00 p.m. PT. The group had recently been discussing alternate proposals for supporting clock forwarded DDR simulations, and the resulting proposal was being introduced today as BIRD204. The group is expecting a BIRD draft from Hansel Dsilva addressing the topic of his DesignCon IBIS Summit presentation "Gap in IBIS for sampling with statistical mode AML models" and providing a way for the model to tell the EDA tool where to place the UI relative to the impulse response.

Task group material can be found at:

http://www.ibis.org/macromodel_wip/

INTERCONNECT TASK GROUP

Michael Mirmak reported that the group meets at 8:00 a.m. PT on Wednesdays. He noted that the focus is still on the EMD proposal (BIRD202). He reported that they are about to review draft 7 of BIRD202.1. There are still some organizational and minor technical issues. They are transitioning to overall editorial review, and the next action will be to finalize it for submission to the Open Forum. They expect to take up some Touchstone issues after that.

Task group material can be found at:

http://www.ibis.org/interconnect_wip/

EDITORIAL TASK GROUP

Michael Mirmak reported the task group remains suspended.

Task group material can be found at:

http://www.ibis.org/editorial_wip/

CHINA REGIONAL FORUM

Lance Wang reported that the third meeting of the CRF, which had been scheduled for Friday, April 24, 2020, had also been cancelled because of a lack of agenda items. Randy Wolff asked that any member organizations with people in China and Taiwan please let Lance know if they have topics Kevin Li could add to the CRF agenda.

China Regional Forum material can be found at:

http://www.ibis.org/china_forum/

NEW ADMINISTRATIVE ISSUES

None.

BIRD204: DQ DQS GetWave Flow for Clock Forwarding Modeling

Walter Katz reviewed the new BIRD. The intent is to allow the AMI_GetWave function for a data signal (e.g., DQ) to get the clock waveform signal (e.g., DQS) or clock ticks as an additional input. The purpose of the BIRD is to support DDR5 and other interfaces with a forwarded clock. The scenario is similar to the typical SerDes scenario supported by AMI, except that the clock is forwarded from the source of the data instead of being recovered from the data. Some companies want to be able to analyze that interaction between DQ and DQS with the AMI model. Walter noted that the BIRD uses the generic terms data and clock, as opposed to DQ and DQS, in all text that is to be added to the specification.

Walter said that for DDR5 the behavior on reads and writes is slightly different. For reads, the controller is the receiver, and the controller's DQ has a phase interpolator to adjust DQ to DQS

skew. For writes, the skew between DQ and DQS is generated at the controller not at the DRAM DQ. Walter described some of the complications that arise in DDR5. For the DQ and DQS sent by the DRAM, the DQS doesn't necessarily clock the DQ it was sent with. There are various delay paths between DQ and DQS in the receiver. Different kinds of jitter can affect the performance at the receiver. The intent of the proposal is to deal with DQ DQS interactions, crosstalk, correlated jitter, and other issues in a clock forwarded system.

Walter noted that an additional issue is that DQS is a strobe, not a clock. When a transfer is initiated, the DQ and DQS have to start up. There are multiple preamble options depending on reading/writing, speed grade, etc., that can get complicated. This proposal will enable the receiver model to have DQ and DQS so analysis of the interactions can be done. Walter said that there had been a lengthy discussion about whether the DQS waveform itself or pre-processed clock ticks should be input to the DQ model. The ATM task group agreed to let the model maker choose which input they wanted. Walter said he thought it was preferable for a model to support legacy mode (DQS input not required), but the proposal allows a model to indicate that it requires the new DQS input.

The proposal introduces a new Reserved parameter `Rx_Use_Clock_Input`, which is usage In. The Value or List of values (allowed values are "None", "Times", "Waves") advertise which options the model supports, and the EDA tool or user selects the option to use for a particular simulation. The `clock_times` argument to `AMI_GetWave` is used as an input if `Rx_Use_Clock_Input` is set to "Times" or "Waves".

Michael Mirmak noted that this proposal had been discussed and reviewed extensively by the ATM task group, and that group had approved submitting it to the Open Forum. He said that in the DDR context this proposal is necessary, but there may be additional information necessary to define the relationship between DQ and DQS. He said it's still up for debate how much of that information will come from IBIS, the user, or an outside source. Walter asked if Michael was referring to things like the preamble information he had mentioned, which would be in JEDEC standards. Michael agreed that was one example, but said he was thinking of something simpler. Without input from the user, how does the tool know of the association between a given DQ and a given DQS for the purposes of setting up this flow? There are questions about whether IBIS is the place to have that information. Walter said we could have something similar to what we have with back-channel support, where the actual protocol itself might be defined elsewhere.

Randy Wolff, Bob Ross, and Michael noted various editorial issues with the BIRD. Michael suggested we send the BIRD back to ATM for review with the expectation that a BIRD204.1 will be submitted. Randy agreed. Randy said he would send out the version he had created with his editorial fixes as a starting point [AR].

BIRD201: BACK-CHANNEL STATISTICAL OPTIMIZATION

Walter Katz said that this BIRD had been introduced a few months earlier, and he had received no feedback or questions. Walter moved to vote on the BIRD. Radek Biernacki said that after a final review of the BIRD he had some concerns. He thought the BIRD did not adequately explain the hand-off between statistical mode training and time domain training in the case when the model supported both. He suggested we explain the behavior under various combinations of simulation type (statistical or time domain) and the three values of

BCI_Training_Mode. Walter agreed that the text could be modified to explain things in more detail and avoid confusion. He said he thought we had general agreement on intent. Walter withdrew his motion. Walter moved to send the BIRD back to ATM to resolve Radek's concerns. Michael Mirmak seconded. There were no objections.

BIRD203: SUBMODEL CLARIFICATIONS

Randy Wolff said that this had been introduced two meetings ago. He had not received any feedback. Randy created this BIRD to add clarifying language regarding the relationship between model and submodel data during extraction and in simulation. Bob Ross noted that BIRD203 had come out of discussion on BUG207. There is no change to the parser behavior, but it clears up the confusion that had led to BUG207. Radek Biernacki said that BUG207 was a legitimate concern, and this clarification was important. Radek moved to vote on the BIRD. Bob Ross seconded the motion. There were no objections.

The roll call vote tally was:

ANSYS – yes
Cadence – yes (email vote)
Google – yes
IBM – yes
Intel – yes
Keysight – yes
Marvell – yes
Mentor – yes
Micron – yes
SiSoft – yes
Synopsys – yes
Teraspeed Labs – yes
Zuken - yes

The roll call vote concluded with a vote tally of Yes – 13, No – 0, Abstain – 0. The vote passed.

Randy Wolff gave Steve Parker an AR to update the status of BIRD203 on the website [AR].

BIRD198.1: KEYWORD ADDITIONS FOR ON DIE PDN (POWER DISTRIBUTION NETWORK) MODELING

Randy Wolff had introduced the latest version of the BIRD at the previous meeting. He reported that he had been working on editorial changes to the BIRD. He said he would send his version to the small working group that had been reviewing the BIRD, and they would bring it back to ATM for review [AR]. Randy anticipated that we would send the BIRD back to the authors after ATM review and see if they approved of all of the changes. The end result is expected to be BIRD198.2.

BIRD166.4: RESOLVING PROBLEMS WITH REDRIVER INIT FLOW

Discussion was tabled.

BIRD181.1: I-V TABLE CLARIFICATIONS

Discussion was tabled.

BIRD190: CLARIFICATION FOR REDRIVER FLOW

Discussion was tabled.

BIRD202: ELECTRICAL DESCRIPTIONS OF MODULES

Discussion was tabled.

IBISCHK PARSER AND BUG STATUS

Bob Ross reported that the Quality task group had finished its work on BUG210 and was ready to classify it. Mike LaBonte said the original example file submitted with BUG210 contained a real problem, a top-level [Model Selector] keyword had been placed before a [Diff Pin] inside a [Component] definition. Since [Model Selector] is outside of the scope of [Component], it ended the [Component] definition and left the [Diff Pin] keyword that followed an orphan keyword outside of the expected [Component] scope. The parser had correctly issued an error, but the “Orphan Component keyword” message was confusing.

To address the confusion and resolve BUG210, the Quality task group proposed revised text for 38 different error messages that had used the term “orphan”. The original messages and their proposed replacements are now included in the bug report form for BUG210. Walter Katz, Radek Biernacki and Michael Mirmak said they liked the new messages.

Bob moved to classify the defect as annoying, low priority, to be fixed in next release. Radek seconded. There were no objections. Bob to update the status of BUG210 [AR].

Bob noted that we will probably have an ibischk7.0.2 parser update to address four or five current BUGs. He said we may choose not to resolve BUG202.

NEW TECHNICAL ISSUES

Randy Wolff shared the Interconnect task group page and noted that an updated example of IBIS 7.0 interconnect model syntax had been posted. Randy explained that Justin Butterfield had prepared an IBIS 7.0 interconnect model syntax example about a year ago. It contained several package models utilizing IBIS-ISS subcircuits, Touchstone, and Touchstone 2.0 and was a comprehensive example. After the official ibischk7 parser was released, they discovered that there were some syntax issues with the example, and it didn't pass the parser. It required a few changes to the IBIS-ISS subcircuits and the interconnect. The new versions are now available for download and use by EDA software.

Michael Mirmak suggested we post a more prominent link to the examples, perhaps in the

version 7.0 page. He said this example was the closest thing to a cookbook that we have for interconnect models. Randy agreed and suggested adding a link to the Unofficial Files Related to IBIS 7.0 section of the IBIS 7.0 page. Steve Parker agreed to add a link to the examples to the Unofficial Files Related to IBIS 7.0 [AR].

NEXT MEETING

The next IBIS Open Forum teleconference meeting will be held on May 15, 2020. The following teleconference meeting is tentatively scheduled for June 5, 2020.

Curtis Clark moved to adjourn. Mike LaBonte seconded the motion. The meeting adjourned.

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NOTES

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This meeting was conducted in accordance with SAE ITC guidelines.

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 ibis@freelists.org and/or ibis-users@freelists.org email lists (formerly ibis@eda.org and ibis-users@eda.org).
- To subscribe to one of the task group email lists: ibis-macro@freelists.org, ibis-interconn@freelists.org, or 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>

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/bugspl.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>

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

SAE STANDARDS BALLOT VOTING STATUS

Organization	Interest Category	Standards Ballot Voting Status	February 21, 2020	March 13, 2020	April 03, 2020	April 24, 2020
ANSYS	User	Active	X	X	X	X
Applied Simulation Technology	User	Inactive	-	-	-	-
Broadcom Ltd.	Producer	Inactive	-	-	-	-
Cadence Design Systems	User	Active	X	-	X	-
Cisco Systems	User	Inactive	-	-	-	-
Dassault Systemes	User	Inactive	-	-	-	-
Ericsson	Producer	Inactive	-	-	-	-
Google	User	Inactive	X	-	-	X
Huawei Technologies	Producer	Inactive	-	-	-	-
Infineon Technologies AG	Producer	Inactive	X	-	-	-
Instituto de Telecomunicações	User	Inactive	-	-	-	-
IBM	Producer	Active	X	X	X	X
Intel Corp.	Producer	Active	X	X	X	X
Keysight Technologies	User	Active	X	X	X	X
Marvell (GLOBALFOUNDRIES)	Producer	Active	X	X	X	X
Maxim Integrated	Producer	Active	X	X	X	-
Mentor, A Siemens Business	User	Active	X	X	X	X
Micron Technology	Producer	Active	X	X	X	X
NXP	Producer	Inactive	-	-	-	-
SerDesDesign.com	User	Inactive	-	-	-	-
SiSoft	User	Active	X	X	X	X
Synopsys	User	Active	X	-	X	X
Teraspeed Labs	General Interest	Active	X	X	X	X
Xilinx	Producer	Inactive	-	-	-	-
ZTE Corp.	User	Inactive	-	-	-	-
Zuken	User	Active	-	X	X	X

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.