

IBIS Open Forum Minutes

Meeting Date: **June 15, 2010**

Meeting Location: **IBIS Summit at Design Automation Conference, Anaheim, CA**

MEMBERS AND 2010 PARTICIPANTS

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Apple Computer	(Matt Herndon)
Applied Simulation Technology	(Fred Balistreri)
ARM	(Nirav Patel)
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Cisco Systems	Syed Huq*, Mike LaBonte, Tony Penalosa, Huyen Pham, Bill Chen, Ravindra Gali, Zhiping Yang
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Huawei Technologies	(Jinjun Li)
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LSI	Brian Burdick
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Micron Technology	Randy Wolff
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Signal Integrity Software	Walter Katz*, Mike Steinberger, Todd Westerhoff*, Barry Katz
Sigrity	Brad Brim, Kumar Keshavan, Srdjan Djordjevic, Ben Franklin
Synopsys	Ted Mido, Paul Lo*, Geoffrey Ying*, Frank Lee*
Teraspeed Consulting Group	Bob Ross*, Tom Dagostino
Texas Instruments	Bonnie Baker
Toshiba	Yoshihiro Hamaji*
Xilinx	Mike Jenkins
ZTE	(Huang Min)
Zuken	Michael Schaeder, Ralf Bruening

OTHER PARTICIPANTS IN 2010

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Avago	Razi Kaw
Bosch Car Multimedia	Rene Steinberg, Patric Kessler
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NetLogic Microsystems	Eric Hsu, Edward Wu, Antonio Orphanou*, Halil Civit*
NXP Semiconductors	Gerald Krasemann
Politecnico di Torino	Igor Stievano, Stefano Grivet-Talocia, Piero Triverio, Flavio Canavero
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Siemens, AG.	Manfred Maurer, Michael Flint
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Span Systems Corporation	Vidya (Viddy) Amirapu
Summit Computer Systems	Bob Davis
Tabula	David Banas*
TechAmerica	(Chris Denham)
Vitesse Semiconductor	Bob McDonough*
Independent	AbdulRahman (Abbey) Rafiq*, Robert Badal

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
July 9, 2010	201 710 432	IBIS

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

<https://cisco.webex.com/cisco/j.php?J=201710432>

All teleconference meetings are 8:00 AM to 9:55 AM 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.

WELCOME AND INTRODUCTIONS

The IBIS Open Forum Summit was held at the Hilton Hotel in Anaheim, California with the Design Automation Conference (DAC). About 26 people representing 21 organizations attended.

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

<http://www.eda-stds.org/ibis/summits/jun10/>

Bob Ross welcomed everyone and thanked Mentor Graphics for making the room arrangements. He had everyone introduce themselves and noted that five attendees were from outside of the US. Based on a show of hands, the attendees represented all interested parties: EDA vendors, semiconductor vendors, and system users of IBIS.

Bob called for opens. Steven Wong asked questions about some potential and actual Touchstone advances. After some brief discussion, Touchstone issues were added as a new item to be discussed later.

IBIS OPEN FORUM REVIEW

Bob Ross, Teraspeed Consulting Group, USA

Bob introduced the structure of IBIS starting with TechAmerica and the Systems and Standards Group headed by Chris Denham. Bob listed the IBIS officers and introduced those who were attending. Bob showed the recent activities under the four task groups. Included in the Quality task group was the introduction of the IBIS Quality Specification, Version 2.0. The Open Forum also advanced or introduced two parsers; ibischk5 with corrections leading to Version 5.0.3, and also tschk2, Version 2.0.

In addition, the IBIS Open Forum held five Summits, has been working on Touchstone proposals and IBIS BUG reports. The official web page contents have been moved to eda.org for easier updating. Overall the IBIS Open Forum financial position is on track for exceeding budget because of more parser sales and probably more members than planned.

Future plans include six Summits (with a new one in Taiwan), IBIS Version 5.1 and ibischk5 bug fixes, Touchstone 2.1 and a tschk2 Version 2.1.0 parser, IBIS-ISS completion, Model

Connection Protocol processing, and an IBIS Correlation Specification project.

Overall the committee has remained active and has broad participation including leading industrial experts. Bob thanked the officers, task group leaders and members for their accomplishments.

CORRELATION UPDATE

Anders Ekholm* and Mike LaBonte**, * Ericsson and **Cisco Systems

Anders gave an overview of the Quality Task Group and its plans for a Correlation Handbook. He noted that the Task Group decided to leave the Accuracy Handbook as-is and focus only on the correlation topic.

Three types of Correlation are being considered:

Overlay and Envelope Metric (discussed in the Accuracy Handbook)

Feature Selective Validation (FSV), with metric correlation

Feature Selective Validation (FSV), IEEE-P1597.2 D6.5

Anders described these metrics. The Overlay metric compares waveforms vertically (amplitudes) or horizontally (such as for time comparisons). The Envelope Metric checks if the response is within the two corner responses. These are documented in the Accuracy Handbook, authored by Greg Edlund. The FSV, metric-correlation method compares selective measurements of interest (high level, low level, rise time, fall time and duty cycle) and was originally presented by David Banas at the June 2007 IBIS Summit. A proposed IEEE standard for FSV had been presented by Bruce Archambeault at a Quality Task Group meeting, and it provides correlation metrics after doing a Fourier transform on the data sets. This allows comparing the lower order coefficient differences for low frequency error tabulations and the higher order coefficients for high frequency error tabulations. A numerical metric can be derived. Some free software has been developed to automate the process, and this is being investigated by the Quality Task Group.

SIMPLE ODT EXTRACTION

Bob Ross, Teraspeed Consulting Group, USA

Bob referenced a June 2007 IBIS presentation on On-Die Termination (ODT) extraction. With only the total I-V extraction available, there are many solutions for decomposing it into the [GND Clamp] and [POWER Clamp] tables. The default extraction is just a proportional allocation based on the deviations from a straight line.

For this presentation, Bob showed how this default case for just the ODT portion (excluding any ESD clamps) could be done for typ/min/max conditions with simple scaling arithmetic. The key is to use or edit the Spice to IBIS (s2ibis2/3) extraction to a range just outside of 0 V and V(max) (relative to ground) for both the [GND Clamp] and [POWER Clamp] extractions. Then the scaling process allows handling the three corners at the same time with spreadsheet mathematics or simple linear transformation equations.

The mathematical key to this is to do the transformations for just the 0 to Vdd(typ/min/max)

ranges, respectively. The [POWER Clamp] tables when expressed in an IBIS Vdd-relative manner (0 V means Vdd) follow the same process as the [GND Clamp]. The final step is to linearly extrapolate all tables to the full -Vdd to 2*Vdd range. While not shown, if ESD clamps need to be added, that would be done separately by adding the ESD contributions to the two regions below 0 V in each of the clamps.

Arpad Muranyi suggested that measuring the ground and Vdd currents might give extra information for direct on-die allocation of currents. Bob mentioned that this looks feasible once some internal currents are taken into account.

ADHOC PRESENTATION ON TOUCHSTONE

In response to the open issue questions about Touchstone, Walter Katz gave a white-board overview of various N-port formats including the sparse matrix format and binary proposals of Touchstone. During the discussion, some other format possibilities were raised including the impulse format and a residue-pole format. Such alternatives are not part of Touchstone, but proposals can be presented to the IBIS Open Forum for consideration.

IBIS-ATM TASK GROUP REPORT

Arpad Muranyi, Mentor Graphics Corporation

Arpad reported that the IBIS Interconnect Spice Subcircuit (IBIS-ISS) specification work was finished, but the May 2010 draft needed more work. Michael Mirmak is serving as its technical editor.

The IBIS-AMI work is continuing. While many extensions have been presented, the Task Group decided on a minimalist approach to clarify the features at this time. A live spreadsheet tracks changes. Currently BIRD112 - IBIS-AMI clock_times Clarification has been proposed (and approved). The Task Group is still working on the reference flow clarification. Other BIRDS are being prepared.

AUTOMATED AMI MODEL GENERATION & VALIDATION

Jose Luis Pino*, Amolak Badesha*, Manuel Luschas**, Antonis Orphanou**, and Halil Civit**,
*Agilent Technologies and **NetLogic Microelectronics

Jose indicated that typical model generation flows can take many months and involve several steps. An Electronic System Level (ESL) methodology based on higher abstractions can reduce time by increasing comprehension in terms of higher level blocks to be filled in later. Details can be entered by customizing Matlab or C++ code.

Jose showed a TX modeling example involving a FIR/IIR filter, gain and n-tap FFE. A standard FIR model should support arbitrary sampling rate, trading off accuracy for reasonable speed. In the example, Reserved Parameters and Model Specific parameters can be entered for generating an AMI wrapper. Some command sequences related to linear-time-invariant (LTI) or non-linear-time-varying (NLTV) models automatically determine if AMI_GetWave is needed. Such automated features, as programmed in Microsoft Visual C++, simplify the AMI model generation process.

Jose provided several other examples of other blocks and some corresponding results. A blind FFE means that it is not adaptive.

Jose also compared a transistor model and an AMI model simulation from TX, package, PCB, and cable to produce an eye diagram. The TX step response was extracted from the transistor model. The transistor model and AMI model simulations showed matching eye diagrams. Jose also showed good correlation with measured responses based on the oscilloscope extracted impulse response.

Jose concluded that ESL flows reduce complexity. Basic building blocks (e.g., FIR/IIR filters, FFE, DFE, CDR, etc.) can be used for starting model development. Customization with IP content can be done with C++ and math-language code.

CONDITIONAL EXPRESSIONS IN IBIS-AMI

Adge Hawes, IBM

Adge stated that this presentation updates the IBIS Summit presentation at DesignCon on February, 4 2010. He gave several benefits for considering conditional expressions. More corners than currently allowed can be specified and rate-dependent and parameter-dependent values can be added.

Adge listed several types of preprocessing:

- Substitution (e.g., \$CORNER.s4p where the \$CORNER value is selected elsewhere)
- Case or Switch statements to select one value based on an index
- Unit conversion (such as between UI and time)
- Threshold (based on values)
- Piecewise Linear Approximation (linearly interpolated values)
- Or any combination of the above

He showed possible implementations of these preprocessing directives. He also discussed some possible language issues. Any language can be used, but Adge cautioned that any open-source language should be linked dynamically to protect IP. Otherwise per the licensing agreement, all the code including company IP might have to become public. Adge listed some useful interpretive languages (C, Forth, Perl, and a LISP-type interpretation) that can provide the syntax for conditional expressions and showed some examples.

Adge concluded that conditional preprocessing is needed. That would remove the need for EDA vendor-specific wrappers for models.

ELECTION OF OFFICERS

Bob Ross listed the slate of the existing 2009-2010 IBIS Officers, all of whom were willing to serve:

Chair: Bob Ross
Vice-Chair: Lance Wang

Secretary: Randy Wolff
Webmaster: Syed Huq
Postmaster: Mike LaBonte
Librarian: Anders Ekholm

Bob indicated that the offices would be voted on, one at a time and in the above order. No other nominations had been received, but nominations including self nominations could be made. Bob then requested nominations for Chair.

Arpad Muranyi nominated Michael Mirmak. No other nominations were made. Bob asked Lance Wang to conduct the vote. Michael Mirmak was elected Chair for 2010-2011.

Bob resumed the election process, one office at a time. All other offices were uncontested and approved by acclamation. Bob congratulated Michael, and Michael thanked Bob for his service. The new officers for 2010-2011 are:

Chair: Michael Mirmak
Vice-Chair: Lance Wang
Secretary: Randy Wolff
Webmaster: Syed Huq
Postmaster: Mike LaBonte
Librarian: Anders Ekholm

Bob presented appreciation gifts to the past officers prior to lunch.

STATISTICAL COVERAGE IN SI SYSTEM SIMULATIONS AND IMPLICATIONS FOR MODELS

Michael Mirmak, Intel Corporation

Michael introduced statistics to mean the broader science of using numerical data to make statements or inferences about groups. For complete, informed SI coverage, statistical concepts can be used for parameter distributions (e.g., PCB impedance in volume manufacturing), defect tolerances, and confidence levels.

SI simulations model the system responses to establish input-output relationships and then examine or test those relationships. In SerDes systems, there are many parameters. Michael illustrated a practical 20 variable (3 choices each) example. A solutions space examination requires 59,049 simulations, and a grid simulation for every case requires 3.48 billion simulations.

One method to reduce simulations is to use Reduced Surface Modeling (RSM) to apply a predictive model based on least-squares fitting. With RSM for a second order fit for 20 variables, the coverage burden in the example can be reduced to 256 cases. The quality of the fit can be checked. The RSM method provides a “model-of-a-model” that makes what-if predictions with relatively few simulations.

Monte Carlo simulations provide worst case analysis. However, it is very unlikely that every

parameter will be at its worst case setting. Worst case design (based on zero errors) is wasteful over-design. Statistical methods are often used to limit errors. The Bit Error Rate (BER) target is one example of such a design goal. Other limiting goals are defects per million (DPM) and 6 Sigma methods applied for manufacturing processes.

Michael gave a brief statistical review. RSM and DPM can be combined. For example, a model can be fitted with RSM and simulated with a million cases. The output parameters such as eye height and eye width can be examined for violations to determine DPM.

Michael summarized that statistical methods maximize efficiency in design and avoid over- or under-design. The IBIS community should encourage statistical concepts for design and data analysis. Several references were given.

PREDICTING BER TO VERY LOW PROBABILITIES

Arpad Muranyi and Vladimir Dmitriev-Zdorov, Mentor Graphics Corporation

Arpad stated that simulations needed to establish 1e-12 bit error rate (BER) goals approach the limits for what can done in a reasonable time. A target BER of 1e-15, for example, might take 35 years to run.

Arpad then gave a Peak Distortion Analysis (PDA) and statistical inter-symbol interference (ISI) primer. PDA is used to find the worst case eye and/or worst case bit sequence. Statistical ISI analysis is used to generate statistical eye diagrams and a probability density function (PDF) and BER. Arpad illustrated this for the simpler case without uncorrelated or random jitter. The smallest opening of a horizontal or vertical bathtub curve is defined by the worst case ISI effects. But the walls can become vertical, making worst case BER predictions impossible.

The tails of the PDF are important because the smaller area or tail contains the BER information for locating the worst case bit sequence. However the type of distribution needs to be known for accurate extrapolation. Arpad showed that Gaussian assumption can be misleading if the actual distribution is not Gaussian.

The worst sequence (WS) can be determined quickly when using analytical algorithms. Arpad discussed a methodology to produce the BER more accurately. The bit sequence is not completely random, but biased (or stressed) with worst case sequences. Then the BER can be more accurate. He illustrated this for IBIS-AMI situation with a normal pseudo random bit sequence and a stressed stimulus bathtub curve. The stressed simulation gave more accurate detail, and when properly rescaled predicted low BER probabilities with greater accuracy.

Arpad concluded that combining the WS algorithm with algorithmic SERDES simulations can predict low BER probabilities reliably and accurately.

BEST PRACTICES FOR DEVELOPING IBIS-AMI MODELS

Walter Katz, Michael Steinberger, and Todd Westerhoff, Signal Integrity Software (SiSoft)

Todd Westerhoff reported that IBIS-AMI has been successful. Models are being delivered by multiple vendors, and portability of high level algorithmic code has not been an issue. However, models are still not fully interchangeable due to vendor-specific implementations for needed, but

non-standardized features. These include analog models, S-parameter analog models, and jitter parameters.

To address these needs now, Todd proposed a best practices document named Opal™. It complies with officially approved IBIS Version 5.0 and proposes a number of best practice guidelines. These are divided into Requirements and Recommendations. This is to encourage industry-wide methods to promote portability of IBIS-AMI models among all vendors. Todd showed a few examples.

Opal™ is being submitted to the IBIS Committee for consideration under a Creative Commons Attribution-No Derivative Works 3.0 license. Todd described the intent of the license terms to keep the document stable unless permission is given by the original authors. The Opal™ name is trademarked because the document represents significant work by the authors. The methods are free for anyone to use. Todd provided responses to a few frequently asked questions. The overall goal is to provide open guidelines for industrial consistency.

Todd indicated that the document is free and publicly available under:

<http://www.opal-ami.com/>

Terry Jernberg, Arpad Muranyi and others expressed concerns and raised questions regarding who really controls the document and what is permitted and not permitted. Todd clarified that if the IBIS Open Forum accepts the document, it can make changes as long as the authors approve. The authors would still make minor editorial corrections discovered in the review process. A concern was raised that this would give one vendor a head start if the IBIS Open Forum accepted or adopted this. Another concern was that there might be other methods for including (Touchstone or S-parameter) files worth exploring.

Bob Ross commented that everyone needs to review the document and explore the licensing issues.

CONCLUDING ITEMS

Bob Ross mentioned the upcoming teleconference meeting and future Asian Summits. He concluded the meeting by thanking Mentor Graphics for the room arrangements and the presenters for making great contributions.

NEXT MEETING

The next IBIS Open Forum teleconference will be held July 9, 2010 from 8:00 to 10:00 AM US Pacific Standard Time.

NOTES

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This meeting was conducted in accordance with the GEIA Legal Guides and GEIA Manual of Organization and Procedure.

The following e-mail addresses are used:

majordomo@eda.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

To join, change, or drop from either or both:
IBIS Open Forum Reflector (ibis@eda.org)
IBIS Users' Group Reflector (ibis-users@eda.org)
State your request.

ibis-info@eda.org

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

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.

ibis-users@eda.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

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/bugform.txt

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/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/bugsplt.txt>

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

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

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 CURRENT MEMBER VOTING STATUS

I/O Buffer Information Specification Committee (IBIS)

Organization	Interest Category	Voting Status	Standards Ballot			
			May 12, 2010	May 21, 2010	June 11, 2010	June 15, 2010
Advanced Micro Devices	Producer	Active	-	X	-	-
Agilent Technologies	User	Active	X	-	X	X
Ansys	User	Inactive	X	-	-	-
Apple Computer	User	Inactive	-	-	-	-
Applied Simulation Technology	User	Inactive	-	-	-	-
ARM	Producer	Inactive	-	-	-	-
Cadence Design Systems	User	Inactive	-	-	-	X
Cisco Systems	User	Active	-	X	X	X
Ericsson	Producer	Active	X	X	X	X
Freescale	Producer	Inactive	-	-	-	-
Green Streak Programs	General Interest	Inactive	-	-	-	-
Huawei Technologies	Producer	Inactive	-	-	-	-
Hitachi ULSI Systems	Producer	Inactive	X	-	-	-
IBM	Producer	Active	-	X	X	X
Infineon Technologies AG	Producer	Inactive	-	-	-	-
Intel Corp.	Producer	Active	-	X	X	X
IO Methodology	User	Active	X	X	X	X
LSI	Producer	Active	-	X	X	-
Mentor Graphics	User	Active	-	-	X	X
Micron Technology	Producer	Active	-	X	X	-
Nokia Siemens Networks	Producer	Active	X	X	X	-
Samtec	Producer	Inactive	-	-	-	-
Signal Integrity Software	User	Active	-	X	X	X
Sigrity	User	Inactive	X	-	-	-
Synopsys	User	Inactive	-	-	-	X
Teraspeed Consulting	General Interest	Active	X	X	X	X
Texas Instruments	Producer	Inactive	-	-	-	-
Toshiba	Producer	Inactive	-	-	-	X
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 TECHAMERICA BALLOT VOTING ARE:

- USERS - MEMBERS THAT UTILIZE ELECTRONIC EQUIPMENT TO PROVIDE SERVICES TO AN END USER.
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- 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.