

IBIS Open Forum Minutes

Meeting Date: **February 2, 2012**

Meeting Location: **DesignCon IBIS Summit, Santa Clara, CA, USA**

VOTING MEMBERS AND 2012 PARTICIPANTS

Agilent	Radek Biernacki*, Yoji Sekine*, Fangyi Rao*
Altera	David Banas*, Hsinho Wu*, Masashi Shimanouchi*
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ANSYS (Ansoft)	(Steve Pytel)
Apple Computer	(Matt Herndon)
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Cisco Systems	David Siadat*, Mike Sapozhnikov*
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Foxconn Technology Group	(Sogo Hsu)
Freescale	(Jon Burnett)
Green Streak Programs	(Lynne Green)
Huawei Technologies	Xiaoqing Dong*
IBM	Adge Hawes*, Greg Edlund*
Infineon Technologies AG	(Christian Sporrer)
Intel Corporation	Michael Mirmak*, Udy Shrivastava*, Stewart Gilbert* Eddie Frie*
IO Methodology	Lance Wang*
LSI	Brian Burdick
Mentor Graphics	Arpad Muranyi*, Vladimir Dmitriev-Zdorov*
Micron Technology	Randy Wolff*
Nokia Siemens Networks GmbH	Eckhard Lenski
QLogic	(James Zhou)
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Sigrity	Raymond Chen*, Yingxin Sun*, Sam Chitwood*
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Zuken	Michael Schaeder*

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University of Illinois	Thomas Comberiate*, Jose Schutt-Aine*
Vitesse Semiconductor	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
February 17, 2012	205 475 958	IBIS

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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 Santa Clara, California at the Santa Clara Convention Center during the 2012 DesignCon conference. About 69 people representing 37 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/feb12/>

Michael Mirmak welcomed everyone to the Summit, opening the meeting at 9:00AM. Michael polled the audience, and there was about an even split of IC designers, EDA vendors, and system designers.

CHAIR'S STATUS REPORT

Michael Mirmak, Intel

Michael Mirmak gave an overview of progress in 2011 including many pending and approved BIRDs, a new release of ibischk and successful Summits. IEC standardization of IBIS 4.2 through IEEE was blocked. He gave some statistics on BIRDs and IBIS version life spans. He introduced the idea of moving to a regular release schedule for IBIS, more similar to EDA software release schedules to keep the standard current. Focus areas for 2012 include closing out IBIS 5.1 including reformatting and getting a parser developed for 5.1 and IBIS-ISS.

Greg Edlund asked how the versioning would be handled, such as major versus minor releases. Michael noted that we haven't kept to a major/minor release schedule in the past with versioning such as in the 4.0/4.1 versions. Details will need to be worked out. Arpad Muranyi asked how this would affect parser licensing. Michael noted that the current parser licensing system may have to change. Ade Hawes suggested a versioning scheme such as year.month (2012.3).

IBIS-ATM TASK GROUP REPORT

Arpad Muranyi, Mentor Graphics

Arpad Muranyi gave an overview and progress report on the ATM task group. He showed a list of BIRDs approved since the DAC IBIS Summit in June, 2011. Many of the BIRDs are clarifications to the IBIS 5.0 AMI specification. For IBIS 5.2, there is a BIRD that improves jitter modeling in IBIS-AMI. Many BIRDs are being discussed related to analog modeling of IBIS-AMI, AMI enhancements, and backchannel and repeater modeling proposals.

A TALE OF TWO PARSERS

Bob Ross, Teraspeed Consulting Group

Bob Ross presented information related to the ibischk5 and tschk2 parsers. Ibischk5 is currently at version 5.0.7. AMI checking was added as well as numbered messages related to errors, warnings, notes and cautions. There are 1155 unique message strings. A sortable spreadsheet is being developed to document these messages. Bob summarized recent BUG

fixes in the code. There are 15 ibischk5 parser purchases to date. 15 BIRDs will affect development of the version 5.1 parser. Parsing of IBIS-AMI models will follow the 5.1 rules, even for 5.0 version models. IBIS-AMI will follow a sub-version plan for changes starting at version 5.1.

The tschk2 parser checks Touchstone 2.0 syntax. The parser development included creating over 440 test cases. A -canonical option can convert Touchstone 1.0 to Touchstone 2.0. There are currently 71 tschk2 messages grouped into several message categories.

Both parsers remain free to users.

Johann Nittmann asked if the tschk2 parser included checks on passivity, causality, etc. Bob responded that it does not.

Walter Katz commented that he would like to see specification releases go to a year.month release label. Walter asked if the parser will look at specific versioning or continue to check all old models against new rules. Bob responded that the plan is to continue to remain upwards compatible and check old models against new rules. Walter commented that he thought the new parsers will require new parser charges with every release. Bob commented that releases beyond IBIS 5.1 are not funded, and the funding model will need to be determined. Michael Mirmak asked Bob to look ahead to IBIS-ISS and comment on how to make the parser for it successful. Bob responded that the parser developer should be responsible for the test cases. Also, he felt that the parser needs to remain simple and be well funded. Finding an HSPICE expert to develop the parser might help. Michael Schaeder wondered about going with an open source development for the parser. Bob noted that this has not been looked at yet.

MODELING ON-DIE POWER SUPPLY DECOUPLING

Randy Wolff*, Lance Wang**, Micron Technology*, IO Methodology**

Randy Wolff gave a quick overview of power integrity modeling with IBIS 5.0 models. He noted that a detailed model of on-die decoupling capacitance is essential to a good power-aware IBIS model. He showed a layout floorplan for a DDR3 style I/O channel and described the various elements that make up the on-die power supply decoupling. Both bypass capacitance and parasitic capacitances exist. An AC sweep on the parasitic capacitance showed a strong dependence on frequency and weak dependence on DC bias. Randy showed a technique of matching an RC ladder-type model to the transistor model using an S-parameter sweep. A model of the parasitic capacitance was optimized first, and then the model was modified to add extra RC elements for the added bypass capacitance.

Simulation results for an SSO situation were shown comparing the transistor model to the IBIS 5.0 model along with various decoupling capacitance models. Randy concluded that a complete model for on-die power supply decoupling must include models of the parasitics capacitances as well as the designed-in capacitances. Also, a method is needed for including complex decoupling models along with an IBIS 5.0 model.

Arpad Muranyi asked if overclocking of the models is an issue. Randy responded that he had tested out some overclocking situations and seen good simulator results. EDA vendors should be mindful of overclocking.

Walter Katz asked about the LTI nature of DDR3. Randy responded that the driver linearity depends on the termination options. Large signal swings may correspond to the driver transitioning into the non-linear region of operation, but small signal swing conditions lend themselves well to LTI assumptions. Walter concluded that BIRD116 wouldn't cover modeling both the on-die decoupling and LTI assumptions.

Todd Westerhoff asked where Randy thought the ringing was coming from as shown in the power supply current simulations. Randy commented that this was due to a resonance between the on-die decoupling capacitance and the package inductance.

A SYSTEM DEVELOPER'S PERSPECTIVE ON AMI

Greg Edlund, IBM

Greg Edlund introduced his experience so far with using IBIS-AMI models. He is one of only a few who have really dug into creating and using AMI models. He noted that one problem has been getting DLLs to run properly. Model-to-hardware correlation is in progress. Greg has been working with the IBIS Quality task group to develop an AMI checklist that will hopefully improve upon completeness, usage, documentation, and accuracy.

Todd Westerhoff asked about the RX training algorithms. Greg responded that this training would not include any backchannel training. Michael Mirmak asked about Greg's inclusion of Touchstone package models in his checklist. Greg responded that he felt that S-parameters would be the most accurate. Michael clarified that he has seen many issues with use of S-parameter data in transient analysis, and w-element or other types of modeling may be good options. There was also a comment about adding to the checklist something about a list of all the files that may go along with the DLL and should be included for the model to simulate.

The usage checklist includes making sure that multiple instances of models will run in one simulation or simultaneously. Greg noted that he has not personally seen this issue. Todd added that the problem definitely exists.

Documentation is very important to using the models correctly. Arpad Muranyi commented that documentation of Samples_per_bit would be useful when the model is only valid for specific bit rates.

Accuracy requires a lab report that includes jitter measurements, correlation and standards compliance. Greg showed an example of IBM's PHY lab report detailing PVT corners, TX jitter and RX stressed eye.

Greg stressed the need for a DLL test bed to check out models independently of EDA vendor software. Todd commented that these test beds exist on the IBIS web site. Michael added that the IBIS model review task group also exists for reviewing models.

Todd also commented that the checklist should make sure that jitter is included in the models.

USING FUNCTIONAL PROGRAMMING LANGUAGES IN IBIS AMI MODELING

David Banas, Altera

David Banas noted that he has been working on AMI modeling over the last six months using functional programming languages. Functional languages provide a means of expressing a desired computation at a higher level of abstraction than imperative languages such as Fortran, C, Perl, etc. He showed an example of generating a Fibonacci sequence using C++ versus Haskell. He noted that an important capability of the functional language is the ability to define an infinite sequence. You also don't have to keep track of an intermediate 'sum' variable, so the functional language is free of intermediate state maintenance. Functional constructs make code easier to read and understand.

Functional languages have properties of succinctness, believability and higher abstraction level. Strong typing makes code that compiles easier to believe. These languages are still too obscure and performance tuning is still a black art. They are a compromise between natural languages and imperative languages. He showed results comparing the Haskell model to the transistor level and C models of a CTLE filter response. Some differences are not understood yet.

There was a question if a Haskell code AMI model had been released. David confirmed that a model has not been released due to support issues and the need to optimize the run-time speed of the GetWave function. Michael Mirmak noted that giving up an abstraction level might not be a good thing. David added that if you know the hardware well and want to describe its functionality in detail, you can describe the functions in finer detail.

CASE STUDY: IBM 15 GB IBIS-AMI MODEL USING DEPENDENCY TABLES

Adge Hawes, IBM

Adge Hawes outlined a chip-to-chip core for 15.0 Gbps operation that includes FFE and DFE taps. The interface has many different settings that require 140 support files to cover all combinations. With conventional AMI configurations, there might be 192 AMI configuration files. Arpad Muranyi asked if all the parameters couldn't just be put into lists. Adge responded that this was possible, but then he'd need to provide a lookup table of valid combinations. Adge described the use of dependency tables as a better way to automatically choose the right parameter settings for specific corners. This does expand the number of corners that could be simulated and reduces the number of configuration files required. A BIRD proposal is being re-introduced as BIRD150.

Adge showed some of the dependencies in the model and an example of a dependency table. The general structure has the first set of variables as inputs and the other variables are outputs. Another way to create a table is to use curly brackets as substitution of variables into a string. This would require curly brackets to be banned from normal variable names. Adge concluded that models are getting more complicated, and dependency tables will make modeling and the user experience better.

Ambish Varma asked why the DLL couldn't call Touchstone files. Adge responded that this must be handled by the EDA software.

Fangyi Rao asked how you keep one table from changing the same variables as another table.

Adge noted that this issue is not addressed by the BIRD. Walter Katz added that the BIRD defines execution order of the dependency tables, so an output of one table could become an input to another dependency table. He also clarified that the EDA tool can take care of exposing certain variables to the user so that they aren't editable in two places.

EFFICIENT END-TO-END SIMULATIONS OF 25G OPTICAL LINKS

Sanjeev Gupta*, Fangyi Rao**, Jing-tao Liu**, Amolak Badesha*, Avago*, Agilent Technologies**

Sanjeev Gupta noted that the bandwidth of traditional electrical links is increasingly limited by channel loss above 25 Gbps. Optical channels have many advantages. He described the pieces of an optical link transceiver. For a full channel simulation, there is a need to model both electrical and optical portions of the link. The optoelectronic devices are nonlinear and have thermal dependencies. The traditional AMI modeling flow needs to be modified to include the optical link. The optical module can be treated as a mid-channel repeater.

There was a question about how you might break up the model if you had a different transceiver on each end of the fiber. Sanjeev noted that you could break up the model if necessary, but usually fiber is sold in specific lengths with the same transceiver at each end. In the case where the fiber and optics are integrated, a single AMI model is sufficient, although it does require the repeater addition to IBIS-AMI.

Fangyi Rao presented the LI and I-V characteristics for the VCSEL. There is a strong thermal dependency. He showed equations of the laser rate, thermal rate and IV characteristics of the VCSEL. The fiber model has its own set of equations. He described the PIN diode that absorbs photons and creates a photocurrent that is converted to voltage by the transimpedance amplifier. Fangyi presented simulation results of eye diagrams, bathtub curves and effects of optical noise, temperature, non-linearities and fiber length.

Walter Katz noted that the jitter BIRD123 handles some of the jitter issues, but the repeater BIRD may not be setup for this application. Arpad Muranyi and Todd Westerhoff questioned if the repeater BIRD was used as-is, or if the approach requires a different BIRD. Fangyi responded that the approach required two DLLs, but the syntax complied with the repeater BIRD. Parameters are included that allow for control of fiber lengths, etc. The results at this time have not been correlated to measurements.

HOW DID WE GET HERE, AND HOW SHOULD WE GO ON?

Arpad Muranyi, Mentor Graphics

Arpad Muranyi noted that the IBIS ATM task group is evaluating various analog modeling BIRDS that involve [External Model] and [External Circuit] keywords. Some proposals deviate from IBIS tradition. The three biggest topics are extension of simulation corners, general purpose versus fixed topology modeling, and file hierarchy related problems.

Arpad summarized the history of the three corners in IBIS as well as the current capabilities of having more than three corners in [External Model]s and [External Circuit]s. For unlimited

corners, BIRD118.2 could be changed to allow a general file reference containing tree-formatted parameter data. This syntax could easily be extended to legacy IBIS.

Arpad presented pros and cons of using fixed topology circuits for analog modeling of IBIS-AMI. BIRD122 and BIRD144 are both subsets of the IBIS-ISS wrapper approach (BIRD 116-118). BIRD122 proposes dependencies that create some hierarchy problems. He also noted that BIRD145 adds some nice capabilities to cascade an I-V based [Model] with an [External Circuit].

AD HOC DISCUSSION: BIRD116 AND “INTRINSIC MODELS”

Walter Katz, Signal Integrity Software

Walter Katz commented that BIRD122 was written before the IBIS-ISS BIRDs were made publically available. BIRD122 covers almost all existing analog modeling needs, but BIRD116 can cover other needs. These circuits could also enhance traditional non-AMI modeling. When BIRD116 is approved for IBIS 5.2, future models by SiSoft will be converted to BIRD116 syntax; they will just have to copy and paste standard syntax. Adding the 4 models proposed in BIRD122 as reference models is desired. To clarify a question of Michael Mirmak, Walter explained that IBIS legacy models could be fit into one of two standard LTI models (assuming LTI operating ranges). The other two models including Touchstone files allow for more complex Tx and Rx models. Walter added that he updated one of the Rx models to include a 50 ohm termination for the S-parameter model as required by some EDA tools.

Walter described a situation where 128 different AMI files are needed to model a Tx, even though all the different models are a simple change in drive impedance and voltage swing. Walter noted that as long as the names he has chosen for the 4 models are not used by two models at the same time, there won't be any SPICE conflicts. Bob Ross commented that if we want reference models, they will need to be checked and follow a specification. Walter commented that he wants to see that everyone avoid naming conflicts of the reference model names he has proposed.

Todd Westerhoff summarized SiSoft's position as supporting BIRD116 and withdrawing BIRD122. BIRD144 has a similar issue. Let it stand if users and EDA vendors really want it. Walter noted a problem with BIRD144. Terminations are an issue. Fangyi Rao commented that if S-parameter models need to be terminated, the termination must be defined. Radek Biernacki agreed in his explanation. Fangyi added that if an EDA tool is just given an S-parameter, it does not have enough information to terminate it properly. This information is needed in addition to the S-parameter file. Arpad Muranyi noted that there were discussions with Scott McMorrow about this issue a year ago, and Arpad presented a foil that noted the need for this information to be added to one of the analog modeling BIRDs. He added that we either need to add the termination to an IBIS-ISS circuit, or the information must be added to the specification. Todd added that BIRD116 does define the termination of Tx as an open circuit.

OPEN DISCUSSION AND AD HOC PRESENTATIONS

Arpad Muranyi noted some confusion on the dependency table. Todd Westerhoff clarified that if a parameter is declared as an input to the model but as an output of a dependency table, then

anything declared in the original model is ignored since it is picked ultimately by the dependency table. Arpad noted that he is confused about the Usage Info used by the dependency table, since this is a new usage of Info.

Mahbubul Bari asked when we can expect IBIS 5.1. Michael Mirmak noted that March 1 is meant to be a cutoff of approved BIRDs for 5.1, and May 1 is a target voting date. A parser development will have to follow.

Mahbubul asked what it would take for BIRD131 with IBIS-AMI repeaters to make it into IBIS 5.1. Michael responded that it is targeted for IBIS 5.2 in the second development cycle of the year.

Arpad asked for feedback on the idea of extending corners in legacy IBIS models using the parameter tree syntax in external files and the dependency table to choose valid corner options. Todd noted that this makes the corners explicit instead of implicit. Walter Katz commented that he hasn't seen legacy modeling needs for more than three corners. Arpad noted that he was under the impression from various discussions and proposals that there was a serious need for unlimited corners in IBIS and saw an opportunity to make that possible by extending the AMI parameterization capabilities to legacy IBIS models.

CONCLUDING ITEMS

Michael Mirmak thanked the presenters, organizers and attendees.

He asked for a motion to adjourn, which was made and seconded. The meeting concluded at approximately 4:45 PM.

NEXT MEETING

The next IBIS Open Forum teleconference will be held February 17, 2012 from 8:00 to 10:00 AM US Pacific Time. A vote on BIRD149.1 is scheduled.

NOTES

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

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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

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.

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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/bugspkt.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>

To create an account on the TechAmerica KAVI workspace, check out:

<http://workspace.techamerica.org/kwspub/join/>

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IBIS CURRENT MEMBER VOTING STATUS

I/O Buffer Information Specification Committee (IBIS)

Organization	Interest Category	Standards Ballot Voting Status	Standards Ballot Voting Status			
			December 9, 2011	January 6, 2012	January 27, 2012	February 2, 2012
Advanced Micro Devices	Producer	Inactive	-	-	-	-
Agilent Technologies	User	Active	X	X	X	X
Altera	Producer	Active	-	X	X	X
ANSYS	User	Inactive	-	-	-	-
Apple Computer	User	Inactive	-	-	-	-
Applied Simulation Technology	User	Inactive	-	-	-	X
Cadence Design Systems	User	Active	X	X	X	X
Cisco Systems	User	Inactive	-	-	-	X
Ericsson	Producer	Inactive	X	-	-	X
Foxconn Technology Group	Producer	Inactive	-	-	-	-
Freescale	Producer	Inactive	-	-	-	-
Green Streak Programs	General Interest	Inactive	-	-	-	-
Huawei Technologies	Producer	Inactive	-	-	-	X
IBM	Producer	Active	X	X	X	X
Infineon Technologies AG	Producer	Inactive	-	-	-	-
Intel Corp.	Producer	Active	X	X	X	X
IO Methodology	User	Active	X	X	X	X
LSI	Producer	Inactive	X	X	-	-
Mentor Graphics	User	Active	X	X	X	X
Micron Technology	Producer	Active	X	X	X	X
Nokia Siemens Networks	Producer	Active	X	X	X	-
QLogic	Producer	Inactive	-	-	-	-
Signal Integrity Software	User	Active	X	X	X	X
Sigrity	User	Inactive	X	-	-	X
Synopsys	User	Inactive	-	-	-	X
Teraspeed Consulting	General Interest	Active	X	X	X	X
Texas Instruments	Producer	Inactive	-	-	-	X
Toshiba	Producer	Inactive	-	-	-	-
Xilinx	Producer	Inactive	-	-	-	X
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

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