

# EIA IBIS Open Forum Minutes

Meeting Date: **November 2, 2007**

## GEIA STANDARDS BALLOT VOTING STATUS

See last page of the minutes for the voting status of all member companies.

## VOTING MEMBERS AND 2007 PARTICIPANTS

Agilent	Ian Dodd, Radek Biernacki, Saliou Dieye, Riccardo Giacometti, Quanli Li, Mike Resso, Chengming Ren, Dong Wei, Tim Wu, Xindong Xue, Nianmin Zhang, Jianping Zhu, Takahiro Sato
AMD	Nam Nguyen*, Tadashi Arai
Ansoft Corporation	Haiqiang Ding, Baolong Li, Ying Liu
Applied Simulation Technology	(Fred Balistreri)
Apple Computer	(Bill Cornelius)
Cadence Design Systems	[Lance Wang], C. Kumar*, Hemant Shah, Patrick dos Santos, Ambrish Varma*, Shangli Wu, Lanbing Chen, Jianwei Hu, Jacob Lai, Yubao Meng, Jian Peng, Ke (Coco) Xu, Liu Zheng, Norikazu Takada, Yukio Masuko, Terry Jernberg*
Cisco Systems	Syed Huq*, Tram Bui, AbdulRahman Rafiq, Huyen Pham, Darja Padilla, Mike LaBonte*, Paul Ruddy, Gurpreet Hundal, Luis Boluna, Ehsan Kabir, Jehyoung Lee, Susmita Mutsuddy, Eddie Wu, Bill (Qinghua) Chen
Ericsson	Anders Ekholm*, Ole Segtum, Peng Fu
Freescale	Jon Burnett
Green Streak Programs	Lynne Green
Hitachi ULSI Systems	Kazuyoshi Shoji, Shinmei Hirano
Intel Corporation	Michael Mirmak*, [Arpad Muranyi], Lili Deng, Haifeng (Bill) Gong, Tao Hu, Karen Kang, Fanghui Li, Maoxin Yin, James Zhou
IO Methodology	Lance Wang, Esther Gao, Nancy Peng, Benny Yan, Xinjun Zhang, Wei Zhu
LSI	Frank Gasparik*, Kim Helliwell, Dinh Tran, Praveen Soora, Brian Burdick*
Mentor Graphics	John Angulo, Arpad Muranyi*, [Ian Dodd], Eric Rongere, Stephane Rousseau, Bill Hargin, Patrick Carrier, Vivian Pan, Tao Wang, Lifu You, Kenji Kushima, Masahiro Nakajima
Micron Technology	Randy Wolff*, Pavani Jella
Nokia Siemens Networks GmbH[1]	Eckhard Lenski, Flavio Maggioni, Roberto Preatoni, Umberto Gatti, Massimo Ceppi

Panasonic	Atsuji Ito
Samtec	(Corey Kimble)
Signal Integrity Software	Barry Katz, Douglas Burns, Mike Steinberger, Walter Katz, Todd Westerhoff*
Sigrity	Sam Chitwood, Sandy Dung, Raymond Chen, Xianfeng Li, Tao (Helen) Xu
STMicroelectronics	(Anil Kalra), Antonio Girardi*, Giacomo Bernardi, Roberto Izzi, Akhilesh Chandra
Synopsys	Ted Mido, Xuefeng Chen, Changlei Zhang
Teraspeed Consulting Group	Bob Ross*, Tom Dagostino
Texas Instruments	Otis Gorley, Richard Ward, Bonnie Baker
Toshiba	Yoshihiro Hamaji, Yasumasa Kondo, Atshshi Osaki Nonyasu Yoshikawa, Toshihiro Tsajimura
Xilinx	Bruce Bandeli, David Banas*
ZTE	Songrui Chen, Xianhui Hu, Wei Jia, Dongfeng Sun Changjun Wang, Ying Xiong, Shenglong Yang Yanfeng Yu, Xiaojun Zhou, Shunlin Zhu
Zuken	Michael Schaefer, Ralf Bruening, John Berrie, Shigeru Hayashi, Hirohiko Matsuwawa

#### **OTHER PARTICIPANTS IN 2007**

74ze Engineering	Linc Jepson
AcconSys	David Lan, Suny Li, Jianfeng Tan, Jiangtao Wu, Frank Xiao
Agere	(Nirav Patel)
Alcatel Shanghai Bell	Wei Li, Lifan Sun
Altera	Hui Liu, Zhe Lin, Ravindra Gali, Salman Jiva
Apache Design Solutions	(Ji Zheng)
Applied Telisis, Inc. (ATI)	Vladimar Mandrusov
ATE Service Corporation	Yutaka Honda
Canon	Seiji Hayashi, Shoji Matsumoto, Tatsuo Nishino, Sakuragi Takamasa, Haruka Watanabe, Nobuaki Yamashita
Cavium Networks	Johann Nittmann
CEC Huada Electronic Design	Weiwei Liu
China Integrated Circuit	Jingcheng Luo
ChipX	Jay Hidy, Oren Dvir
Cybernet Systems	[Kazuhiki Kusunoki], Masahito Kobayashi, Junko Kuriyama
Datang Mobile	Fanjie Meng, Hongying Li, Hongwei Wang
EDN China	Frank Yao
EE Times Japan	Norihiro Satsukawa
EFM	Ekkehard Miersch
EMC Technology	Michael Liu, Feng Lu, Changzheng Yang

Enterasys	Robert Haller
Extreme Networks	Kevin Ko
Fluent	(Chetan Desai)
Force10 Networks	Robert Badal
Free Electron Software	Al Davis
Fujitsu Limited	Kouichiro Asoh, Tetsuya Inoue, Toshiro Sato, Fujimori Shogo, Wasaki Tosaka
GEIA	(Chris Denham)
Gnovo Technologies	Harris Ma
Hangzhou H3C Technologies	Chunbao Yan
Hewlett Packard	Shafiq Rahman
Huawei 3Com	Junjun Cui, Zhenyu Liu, Jun Mao, Bao Wang, Kai Xie, Haitao Zhang
Huawei Technologies	ChunXing Huang, Bob He, Tao Guan, Peng Hu, Xiangzhong Jiang, Meidan Liu, Haiyan Yu
IBM	Michael Sorna, Adge Hawes*, Kevin Kramer*, Wei Wang
IMECAS	Yunfeng Wang
IVIS Co.	Hiroyuki Mashima
Infineon	Christian Sporrer
Integrated Circuit Systems (ICS)	(Dan Clementi)
Japan Aviation Electronics Industries	Hiroaki Ikeda
JEITA	Atsushi Ishikawa
Juniper Networks	Raul Lozano
Kawasaki Microelectronics	Hiroyuki Sato, Takashi Kawahara
Leventhal Design	Roy Leventhal
LHWT Microelectronics	Jiahui Wang
Lynquent	[Andrew Levy]
Motorola	Hong Chen, Haiying Jiang, Daniel Tang
National Institute of Applied Science (INSA)	Etienne Sicard
National Instruments	Lee Maixman
Netlogic	Eric Hsu
NEC Electronics Corporation	Takeshi Watanabe, Hock Seow, Huy Tran, Itsuki Yamada
NESA	Edward Sayre
Northrop Grumman	Dusan Radosevic
Nortel Networks	Jingxin Bian, Feng Shi
Nuova Systems	Zhiping Yang, Lin Shen
NVIDA Corporation	Jing (Jane) Zhang
NXP	[H N Sudarshan]
Optimal Corporation	Marc Kowalski
Politecnico di Torino	Igor Stievano, Michelangelo Bandinu
Renesas Technology	Takuji Komeda

Samsung	Sang-Soo Park
Sedona International	Joe Socha
Sharp	Tetsuo Iwaki
Shizu Technology	Zuofu Qi
Siemens AG [1]	[Eckhard Lenski], Manfred Maurer
Silego	(Joe Froniewski)
Sony Corporation	Toshiro Honda, Keisuke Matsunami
Shu Zi Tai He	Chunyu Zhao
Sun Microelectronics	Leon Yang
Tiburon Design Automation	Patrick O'Halloran
Via Technologies	Jimmy Hsu
White Electronics Designs	John Perez
Xyratex	Paul Levin, Joseph Chan
Zuken Support and Service	Seikou Go, Tomotaka Unose

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	Telephone Number	Bridge #	Passcode
November 30, 2007	1-916-356-2663	4	814-2164

All 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, provide the bridge number and passcode at the automated prompts. If asked by an operator, please request to join the IBIS Open Forum hosted by Michael Mirmak. For international dial-in numbers, please contact Michael Mirmak.

NOTE: "AR" = Action Required.

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## INTRODUCTIONS AND MEETING QUORUM

Kevin Kramer from IBM introduced himself. He manages a high speed SerDes group in Fishkill, NY. His group is trying to create IBIS models for SerDes devices. Adge Hawes from IBM in the UK introduced himself. He works on high speed serial links and is working on support of the algorithmic modeling using IBIS.

## CALL FOR PATENTS

Michael Mirmak called for any patents or pending patents related to the IBIS Version 3.2, 4.0, 4.1, 4.2, or ICM 1.1 specifications. No patents were declared.

## **MEMBERSHIP UPDATE AND TREASURER'S REPORT**

Michael Mirmak reported that we stand at 29 paid members officially. ST Microelectronics representatives are changing. We currently stand to have a net profit for the year, so we will have to look into zeroing out the profit at some point.

## **REVIEW OF MINUTES AND ARS**

Michael Mirmak called for comment regarding the minutes of the October 12, 2007 IBIS Open Forum teleconference. Randy Wolff noted that Michael Mirmak spotted a misspelling of Datang Mobile as "Dangtang Mobile" in previous minutes. The misspelling is fixed and noted in the current set of minutes. The minutes were approved without changes.

## **WEB PAGE UPDATES**

Syed Huq reported that he updated the roster to add ARM. He is also making changes to ST Microelectronics and on the poster page. Ambrish Varma asked again about adding a link to Open Forum emails on the main page. Syed said he is working on a fix for that request.

## **MAILING LIST ADMINISTRATION**

Bob Ross reported that everything is running normally.

## **MODEL LIBRARY UPDATE**

Michael Mirmak reported for Lance Wang that library enhancements are being posted right now. Link fixes and graphical updates for Fujitsu were made.

## **PRESS UPDATE**

Bob Ross noted that he would mention various press updates in subsequent topics.

Michael Mirmak mentioned seeing extensive mentions of API, AMS, and IBIS mentioned on the SI list recently.

## **MISCELLANY/ANNOUNCEMENTS**

Michael Mirmak said that the Open Forum is looking at WebEx, Skype and other online meeting options for future teleconferences. He requested that if any member companies would like to donate this access, to please let the open forum know.

Michael also announced that new executables of the IBISCHK 4.2.2 parser for Ubuntu 6.06 are posted online.

## **OPENS FOR NEW ISSUES**

Bob Ross noted the need to schedule a vote on BIRD97. He also asked that the committee discuss future summit preparations for both DATE and Taiwan.

## **INTERNATIONAL/EXTERNAL PROGRESS**

Upcoming conferences of interest to IBIS members are listed below.

The 6th International Workshop on Electromagnetic Compatibility of Integrated Circuits (EMC Compo 2007) is to be held November 28-30, 2007, in Torino, Italy. There will be some sessions mentioning IBIS. More information can be found at:

<http://www.emccompo07.polito.it/>

EPEP was held October 29-31. Ambrish Varma attended and presented a paper entitled "System Level Validation of improved IO Buffer Behavioral Modeling Methodology Based on IBIS." Ambrish noted that there were other presentations on macro-modeling including one from Politecnico di Torino that mentioned IBIS. More information can be found at:

<http://www.epep.org/technicalprogram.html>

Michael Mirmak noted that the IEEE 1076.1-2007 (VHDL-AMS) specification will be available officially November 15, 2007.

Syed Huq reported that he missed the last DASC encryption meeting, so he had no update. He did mention that the group changed to entity level voting from individual voting.

The IEEE DASC Study Group on Encryption website is found at:

<http://www.eda-stds.org/ip-encrypt/hm/>

Michael Mirmak noted a discussion within GEIA of a new membership class being formed called Associate membership. If this ends up effecting IBIS, the membership will be informed.

## **IEC APPROVAL ACTIVITIES**

Randy Wolff reported that Michael Mirmak wrote an email recently to John Messina and Dennis Brophy who are both involved with the IEC TC93 committee. He enquired about IEC standardization. Michael mentioned that he has not gotten a response yet.

## **SUMMITS**

- Design Con Planning

DesignCon 2008 will be held February 4-7, 2008 at the Santa Clara convention center. The IBIS Summit is tentatively scheduled for Thursday, February 7, 2008. Syed Huq will be the main contact for the event. Michael Mirmak received a contract proposal from IEC for display booth space and a conference room. Other details including insurance for the booth are being worked on. Bob Ross noted a large number of people doing presentations at DesignCon who are active in IBIS. A conference schedule has been published at the following link:

<http://www.designcon.com/2008/conference/schedule.html>

We will be putting out a call for papers in a few weeks. Cisco is officially sponsoring this summit.

- DATE Planning

The DATE conference will be in Munich, Germany March 10-14, 2008. Bob mentioned that we should get started on organizing a meeting room and picking the date. The meeting will be either March 13 or 14.

Bob Ross noted that we are informally discussing having a summit in Taiwan, including possible dates for a summit in Taipei. The committee is looking for local contacts in Taipei. There is a strong possibility of a summit in Taiwan next year.

Sponsorship opportunities for the DesignCon IBIS summit are available, with sponsors receiving free mentions in the minutes, agenda, and other announcements. Contact the IBIS Board for further details.

#### **IBIS QUALITY TASK GROUP**

Mike LaBonte reported that the group talked over the JEITA suggestions during the last two meetings. They will continue to review the specification in future meetings. The group continues to meet every Tuesday at 11:00am ET.

The Quality Task Group checklist and other documentation can be found at:

[http://www.eda-stds.org/ibis/quality\\_wip/](http://www.eda-stds.org/ibis/quality_wip/)

#### **IBIS MODEL REVIEW TASK GROUP**

No update.

#### **ADVANCED TECHNOLOGY MODELING TASK GROUP**

Arpad Muranyi reported that the group discussed changes to differential models at the last two meetings. They have done no further work on the AMI BIRD. They are discussing other possible fixes to make in the IBIS specification as well.

Task group material can be found at:

[http://www.eda-stds.org/ibis/macromodel\\_wip/](http://www.eda-stds.org/ibis/macromodel_wip/)

#### **AD HOC TASK GROUPS (INTERCONNECT)**

Michael Mirmak reported that the group had a meeting last week. They are finishing the Touchstone 2.0 document. The group is close to having a final version for presentation and review at the Open Forum.

Task group material can be found at:

<http://www.eda.org/ibis/adhoc/interconnect/>

## **NEW ISSUES**

None.

### **BIRD98.3: GATE MODULATION EFFECT (TABLE MODEL)**

Bob Ross reported that there have been no changes to the BIRD, so it is ready for a vote. Arpad Muranyi noted that if BIRD 98.3 is approved, BIRD 97 should be voted down. Arpad mentioned technical issues still unresolved by this BIRD and asked if there will be more work done to address the other issues. Bob felt that this BIRD is a good first step and future BIRDS could cover other issues such as modulation of clamp tables. Ambrish Varma mentioned that he investigated the BIRD and other techniques for gate modulation modeling, and he felt the BIRD was sound.

Bob Ross noted that Ambrish Varma's Ph.D. thesis, "Improved Behavioral Modeling Based on the Input Output Buffer Information Specification" details gate modulation in IBIS models. The paper can be found at the following link:

<http://www.lib.ncsu.edu/theses/available/etd-01042007-012012/>

A motion was made to vote on BIRD98.3 for inclusion in the next version of the IBIS specification. The vote passed with the following vote tally:

AMD	- yes
Cadence	- yes
Cisco	- yes
Ericsson	- abstain
Intel	- yes
LSI	- yes
Mentor	- yes
Micron	- yes
SiSoft	- yes
STMicro	- yes
Teraspeed	- yes
Xilinx	- yes

BIRD97 will be scheduled for a vote at the next meeting.

### **BIRD104: ALGORITHMIC MODELING API (AMI) SUPPORT IN IBIS**

Bob Ross noted seeing only his one comment on the reflector to be more specific on the



reference to the ANSI C specification noted in the BIRD. Ambrish Varma said he would make sure this text was updated in the BIRD. Arpad Muranyi asked when the BIRD could be brought up for a vote. It was decided to schedule it for the next meeting.

Bob mentioned that a tutorial and a paper related to BIRD104 and algorithmic modeling are scheduled on the DesignCon program:

Monday 1:30 - 4:30 - Developing Interoperable Algorithmic Models Quickly - A Tutorial  
Ambrish Varma (Cadence), Colin Warwick (Mathworks), C. Kumar (Cadence)

Tues 10:15-10:55 Demonstration of SerDes Modeling Using the Algorithmic Model  
Interface Standard  
Michael Steinberger, Todd Westerhoff, Christopher White (SiSoft)

Adge Hawes mentioned that IBM has been working with the BIRD and the toolkits, and they should have some demonstrations prepared by DesignCon.

### **IBISCHK4 BUG STATUS**

No new BUGs have been filed. There is new compiled code of IBISCHK4.2.2 for Ubuntu 6.06 (Linux) available for download.

### **ICMCHK1 BUG STATUS**

Michael Mirmak reported that there is one BUG, but it will not be fixed until the next version of the parser. The next release of the parser will come out once IIRD9 is closed.

### **IBIS ENHANCEMENT PRIORITIES**

Michael Mirmak presented on where the specification is at and how we decide where we are going. He showed current BIRDS that are pending for inclusion in IBIS 5.0. He asked if these BIRDS are sufficient to keep IBIS relevant in the industry. He showed results from an informal survey of IBIS that showed that recent enhancements are not well known and some long standing problems are still not fixed. Todd Westerhoff asked if recent enhancements aren't being utilized, is it because there aren't tools to help in modeling or support in the software? Todd also noted it is very difficult to talk about what we can or can't model with different modeling technologies and what the exact tradeoffs are – what is good enough? Michael noted that changes to the IBIS specification are becoming tougher as the specification grows. He showed examples of colliding, complex proposals that attempt to fix problems while at the same time maintaining backwards compatibility. He asked which is worse: updating old keywords, removing them entirely or adding new “override” keywords? He asked what the most pressing industry needs are, what is the IBIS “market segment” of highest interest, and how can we best address the perception problem? Ambrish Varma asked if it would be appropriate to split the specification. Michael felt that this was an option worth discussing. Todd felt that the biggest question to decide was what are we supporting and where do we want the specification to be in 3-5 years. Arpad noted that we didn't architect the specification in an extensible way. If he could start over, he would look at other available programming and modeling languages and take features from others to make a flexible specification.

Michael's presentation can be found at the following link:

<http://www.eda.org/ibis/docs/ibis-enhancement-priorities.pdf>

## **NEW TECHNICAL ISSUES**

None.

## **OPEN ISSUES**

None.

## **NEXT MEETING**

The next IBIS Open Forum teleconference will be held November 30, 2007 from 8:00 AM to 10:00 AM US Pacific Time. A vote is scheduled for BIRD97 and BIRD104.

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## **NOTES**

IBIS CHAIR: Michael Mirmak (916) 356-4261, Fax: (916) 377-3788

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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-stds.org](mailto:majordomo@eda-stds.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-stds.org](mailto:ibis-request@eda-stds.org)

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

[ibis-info@eda-stds.org](mailto:ibis-info@eda-stds.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-stds.org](mailto:ibis@eda-stds.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-stds.org](mailto:ibis-users@eda-stds.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-stds.org](mailto:ibis-bug@eda-stds.org)

To report ibischk parser BUGs. The BUG Report Form resides along with reported BUGs at:

<http://www.eda-stds.org/ibis/bugs/ibischk/>

<http://www.eda-stds.org/ibis/bugs/ibischk/bugform.txt>

[icm-bug@eda-stds.org](mailto:icm-bug@eda-stds.org)

To report icmchk1 parser BUGs. The BUG Report Form resides along with reported BUGs at:

[http://www.eda-stds.org/ibis/icm\\_bugs/](http://www.eda-stds.org/ibis/icm_bugs/)

[http://www.eda-stds.org/ibis/icm\\_bugs/icm\\_bugform.txt](http://www.eda-stds.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-stds.org/ibis/bugs/s2ibis/bugs2i.txt>

<http://www.eda-stds.org/ibis/bugs/s2ibis2/bugs2i2.txt>

<http://www.eda-stds.org/ibis/bugs/s2iplt/bugspl.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-stds.org/ibis/directory.html>

All eda.org documents can be accessed using a mirror:

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

Note that the "/ibis" text should be removed from directory names when this URL mirror is used.

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## GEIA STANDARDS BALLOT VOTING STATUS

### I/O Buffer Information Specification Committee (IBIS)

Organization	Interest Category	Standards Ballot Voting Status	September 14, 2007	September 21, 2007	October 12, 2007	November 2, 2007
Advanced Micro Devices	Producer	Active	√	√	√	√
Agilent Technologies	User	Inactive	√			
Ansoft	User	Inactive				
Apple Computer	User	Inactive				
Applied Simulation Technology	User	Inactive				
Cadence Design Systems	User	Active	√		√	√
Cisco Systems	User	Active	√	√	√	√
Ericsson	Producer	Active	√	√	√	√
Freescale	Producer	Inactive				
Green Streak Programs	General Interest	Inactive				
Hitachi ULSI Systems	Producer	Inactive	√			
Intel Corp.	Producer	Active	√	√	√	√
IO Methodology	User	Inactive	√		√	
LSI Logic	Producer	Active		√	√	√
Mentor Graphics	User	Active	√		√	√
Micron Technology	Producer	Active		√	√	√
Nokia Siemens Networks	Producer	Inactive		√		
Panasonic	Producer	Inactive	√			
Samtec	Producer	Inactive				
Signal Integrity Software	User	Active	√		√	√
Sigrity	User	Inactive	√			
STMicroelectronics	Producer	Active	√		√	√
Synopsys	User	Inactive				
Teraspeed Consulting	General Interest	Active	√	√	√	√
Texas Instruments	Producer	Inactive				
Toshiba	Producer	Inactive	√			
Xilinx	Producer	Active	√	√	√	√
ZTE	User	Inactive				
Zuken GmbH	User	Inactive	√			

#### 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 GEIA 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.