

Agenda and General Information

IEEE 802.3 EPON Protocol over Coax
(EPoC) PHY Study Group

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Broadcom
Minneapolis, MN
15-May-2012

Agenda

- Appointment of recording secretary
- Welcome and introductions
- Approve agenda
- Approve minutes from January
- Goals for this meeting
- Reflector and web
- Ground rules
- IEEE
 - Structure
 - Bylaws and Rules
 - Call for Patents
 - IEEE Standards Process
- Liaisons and communications
- Recap of last meeting
- Presentations
- Motions and closing business
- Future meetings

Task Force Decorum



- Photography or recording by permission only (2010 SASB Op Manual 5.3.3.4)
- Cell phone ringers off
- Press (i.e., anyone reporting publicly on this meeting) are to announce their presence (5.3.3.5)
- Wear your badges at all times in meeting areas
 - Help the hotel security staff improve the general security of the meeting rooms
 - **PCs HAVE BEEN STOLEN** at previous meetings
 - **DO NOT** assume that meeting areas are secure
- Please observe proper decorum in meetings

Goals for the meeting

- Hear presentations on requirements, architecture, technical feasibility, objectives, 5 Criteria, and PAR
- Continue work on objectives, 5 Criteria and PAR
 - Hopefully approval text for all

Reflector and Web

- To subscribe to the EPoC Study Group reflector, send an email to:

ListServ@ieee.org

with the following in the body of the message (do not include “<>”):

subscribe stds-802-3-epoc <yourfirstname> <yourlastname>

end

- Send EPoC Study Group reflector messages to:

stds-802-3-epoc@listserv.ieee.org

- Study Group web page URL:

<http://www.ieee802.org/3/epoc/>

Task Force Private Area

- Not yet established
- Will be once we have a draft, or other material requiring password protection
- Note - The draft, and any other content, is posted for your review only, and neither the content nor access information should be copied or redistributed to others in violation of document copyrights.

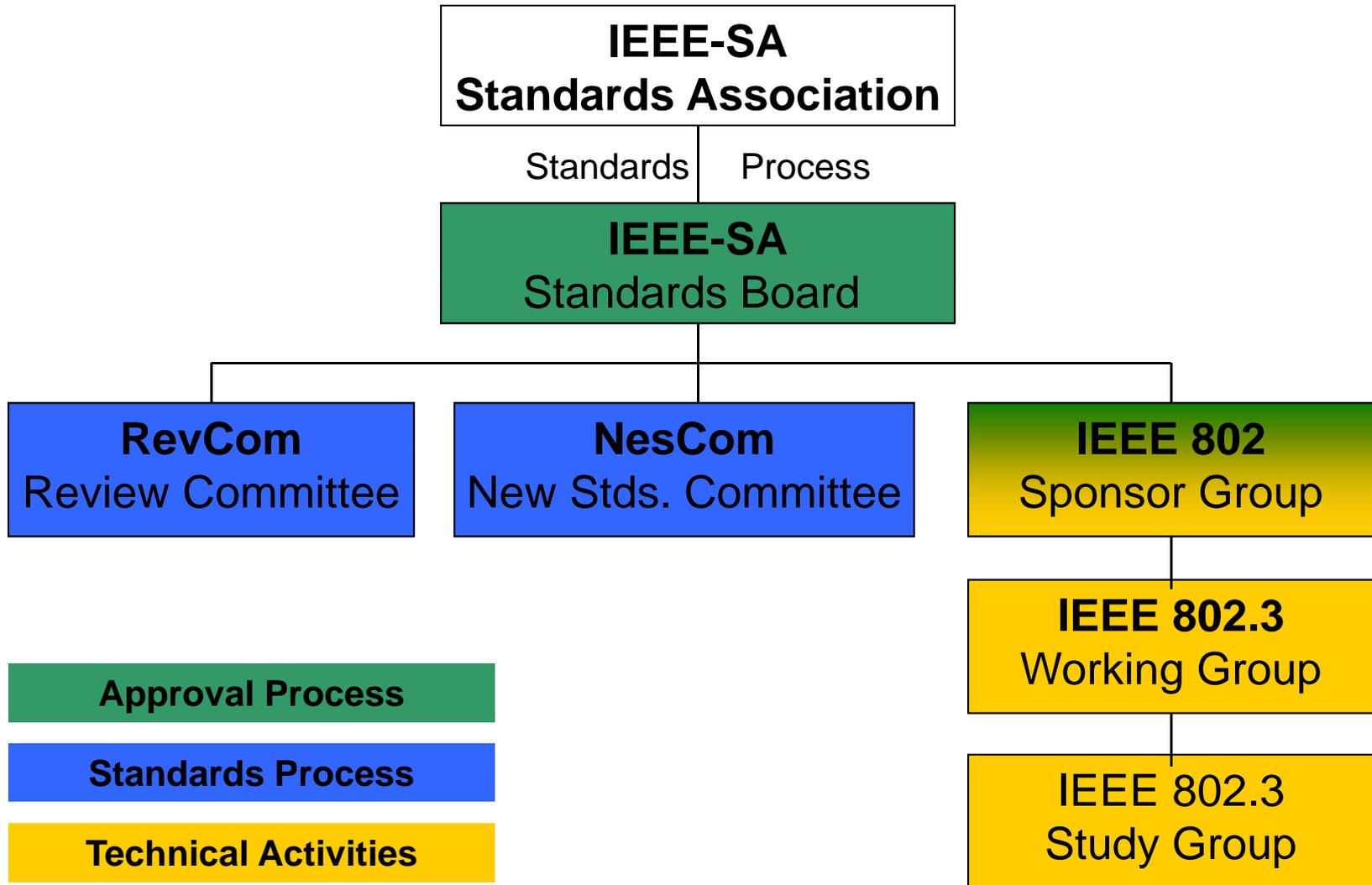
Ground Rules

- Based upon IEEE 802.3 Rules
 - Foundation based upon Robert's Rules of Order
 - Anyone in the room may speak
 - Anyone in the room may vote
- **RESPECT**... give it, get it
- NO product pitches
- NO corporate pitches
- NO prices!!!
 - This includes costs, ASPs, etc. no matter what the currency
- NO restrictive notices

Attendance

- Tutorial Material on attendance tool
 - http://ieee802.org/3/minutes/mar11/0311_imat.pdf
- URL: <https://seabass.ieee.org/imat/index>

IEEE Structure



Important Bylaws and Rules

- **IEEE-SA Operations Manual**
<http://standards.ieee.org/sa/sa-om.pdf>
- **IEEE-SA Standards Board Bylaws**
<http://standards.ieee.org/guides/bylaws/sb-bylaws.pdf>
- **IEEE-SA Standards Board Operations Manual**
<http://standards.ieee.org/guides/opman/sb-om.pdf>
- **IEEE 802 LAN/MAN Standards Committee (LMSC) Policies and Procedures**
<http://standards.ieee.org/about/sasb/audcom/pnp/LMSC.pdf>
- **IEEE 802 LAN/MAN Standards Committee (LMSC) Operations Manual**
http://www.ieee802.org/PNP/2010-07/IEEE_802_LMSC_OM_approved_100716.pdf
- **IEEE 802 LAN/MAN Standards Committee (LMSC) Working Group (WG) Policies and Procedures**
http://www.ieee802.org/PNP/2010-07/IEEE_802_LMSC_WG_PandP_approved_100716.pdf
- **IEEE 802.3 Working Group Operating Rules**
http://ieee802.org/3/rules/P802_3_rules.pdf

Instructions for the WG Chair

The IEEE-SA strongly recommends that at each WG meeting the chair or a designee:

- Show slides #1 through #4 of this presentation
- Advise the WG attendees that:
 - The IEEE's patent policy is consistent with the ANSI patent policy and is described in Clause 6 of the *IEEE-SA Standards Board Bylaws*;
 - Early identification of patent claims which may be essential for the use of standards under development is strongly encouraged;
 - There may be Essential Patent Claims of which the IEEE is not aware. Additionally, neither the IEEE, the WG, nor the WG chair can ensure the accuracy or completeness of any assurance or whether any such assurance is, in fact, of a Patent Claim that is essential for the use of the standard under development.
- Instruct the WG Secretary to record in the minutes of the relevant WG meeting:
 - That the foregoing information was provided and that slides 1 through 4 (and this slide 0, if applicable) were shown;
 - That the chair or designee provided an opportunity for participants to identify patent claim(s)/patent application claim(s) and/or the holder of patent claim(s)/patent application claim(s) of which the participant is personally aware and that may be essential for the use of that standard
 - Any responses that were given, specifically the patent claim(s)/patent application claim(s) and/or the holder of the patent claim(s)/patent application claim(s) that were identified (if any) and by whom.
- The WG Chair shall ensure that a request is made to any identified holders of potential essential patent claim(s) to complete and submit a Letter of Assurance.
- It is recommended that the WG chair review the guidance in *IEEE-SA Standards Board Operations Manual* 6.3.5 and in FAQs 12 and 12a on inclusion of potential Essential Patent Claims by incorporation or by reference.

Note: **WG** includes Working Groups, Task Groups, and other standards-developing committees with a PAR approved by the IEEE-SA Standards Board.



25 March 2008 (updated 29 March 2011)

(Optional to be shown)

Participants, Patents, and Duty to Inform

All participants in this meeting have certain obligations under the IEEE-SA Patent Policy.

- Participants [Note: Quoted text excerpted from IEEE-SA Standards Board Bylaws subclause 6.2]:
 - “Shall inform the IEEE (or cause the IEEE to be informed)” of the identity of each “holder of any potential Essential Patent Claims of which they are personally aware” if the claims are owned or controlled by the participant or the entity the participant is from, employed by, or otherwise represents
 - “Personal awareness” means that the participant “is personally aware that the holder may have a potential Essential Patent Claim,” even if the participant is not personally aware of the specific patents or patent claims
 - “Should inform the IEEE (or cause the IEEE to be informed)” of the identity of “any other holders of such potential Essential Patent Claims” (that is, third parties that are not affiliated with the participant, with the participant’s employer, or with anyone else that the participant is from or otherwise represents)
- The above does not apply if the patent claim is already the subject of an Accepted Letter of Assurance that applies to the proposed standard(s) under consideration by this group
- Early identification of holders of potential Essential Patent Claims is strongly encouraged
- No duty to perform a patent search

Patent Related Links

All participants should be familiar with their obligations under the IEEE-SA Policies & Procedures for standards development.

Patent Policy is stated in these sources:

IEEE-SA Standards Boards Bylaws

<http://standards.ieee.org/develop/policies/bylaws/sect6-7.html#6>

IEEE-SA Standards Board Operations Manual

<http://standards.ieee.org/develop/policies/opman/sect6.html#6.3>

Material about the patent policy is available at

<http://standards.ieee.org/about/sasb/patcom/materials.html>

If you have questions, contact the IEEE-SA Standards Board Patent Committee Administrator at patcom@ieee.org or visit <http://standards.ieee.org/about/sasb/patcom/index.html>

This slide set is available at
<https://development.standards.ieee.org/myproject/Public/mytools/mob/slideset.ppt>

Call for Potentially Essential Patents

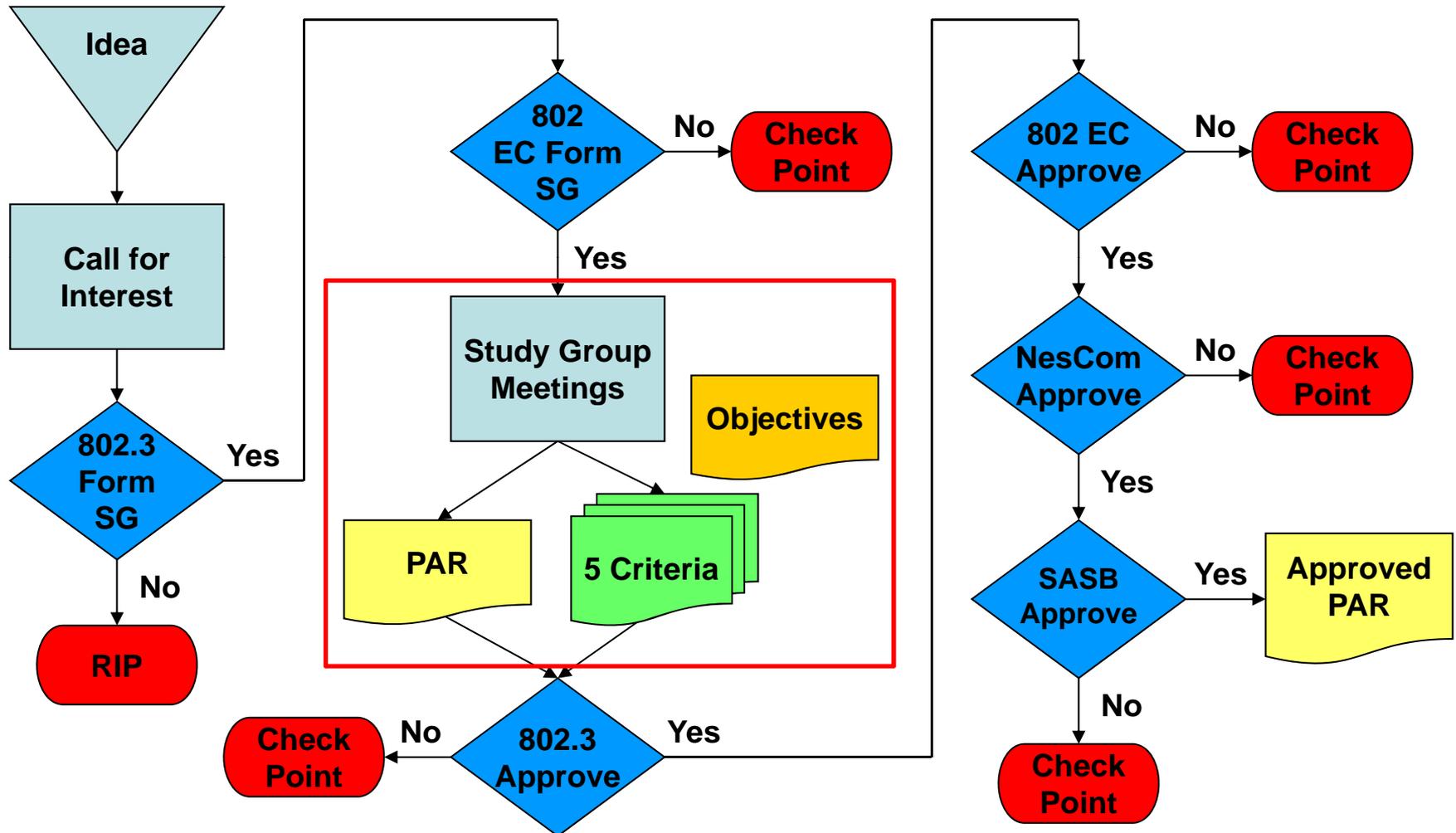
- If anyone in this meeting is personally aware of the holder of any patent claims that are potentially essential to implementation of the proposed standard(s) under consideration by this group and that are not already the subject of an Accepted Letter of Assurance:
 - Either speak up now or
 - Provide the chair of this group with the identity of the holder(s) of any and all such claims as soon as possible or
 - Cause an LOA to be submitted

Other Guidelines for IEEE WG Meetings

- **All IEEE-SA standards meetings shall be conducted in compliance with all applicable laws, including antitrust and competition laws.**
 - **Don't discuss the interpretation, validity, or essentiality of patents/patent claims.**
 - **Don't discuss specific license rates, terms, or conditions.**
 - Relative costs, including licensing costs of essential patent claims, of different technical approaches may be discussed in standards development meetings.
 - Technical considerations remain primary focus
 - **Don't discuss or engage in the fixing of product prices, allocation of customers, or division of sales markets.**
 - **Don't discuss the status or substance of ongoing or threatened litigation.**
 - **Don't be silent if inappropriate topics are discussed ... do formally object.**

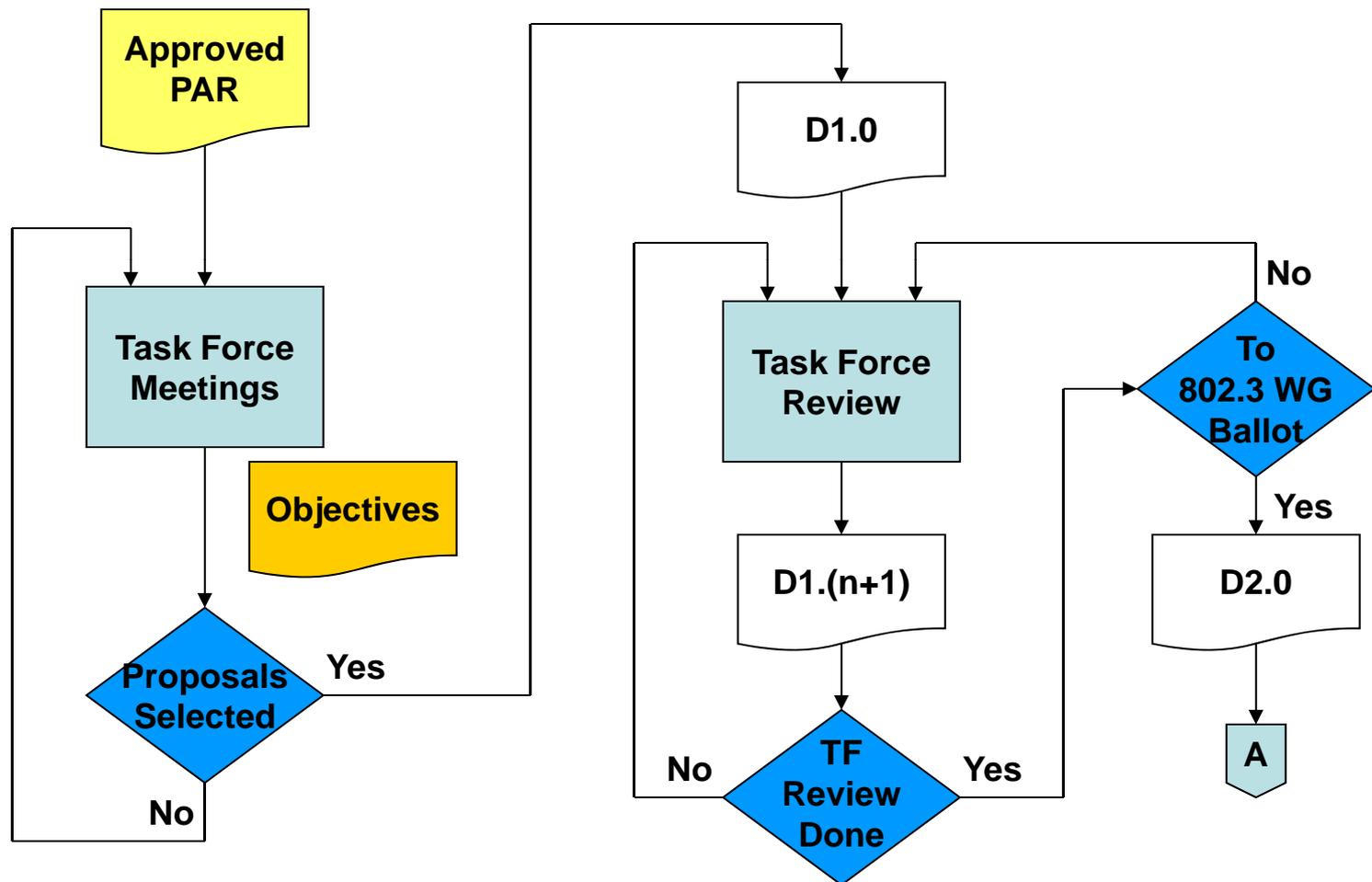
See *IEEE-SA Standards Board Operations Manual*, clause 5.3.10 and “Promoting Competition and Innovation: What You Need to Know about the IEEE Standards Association's Antitrust and Competition Policy” for more details.

Overview of IEEE 802.3 Standards Process (1/5)- Study Group Phase

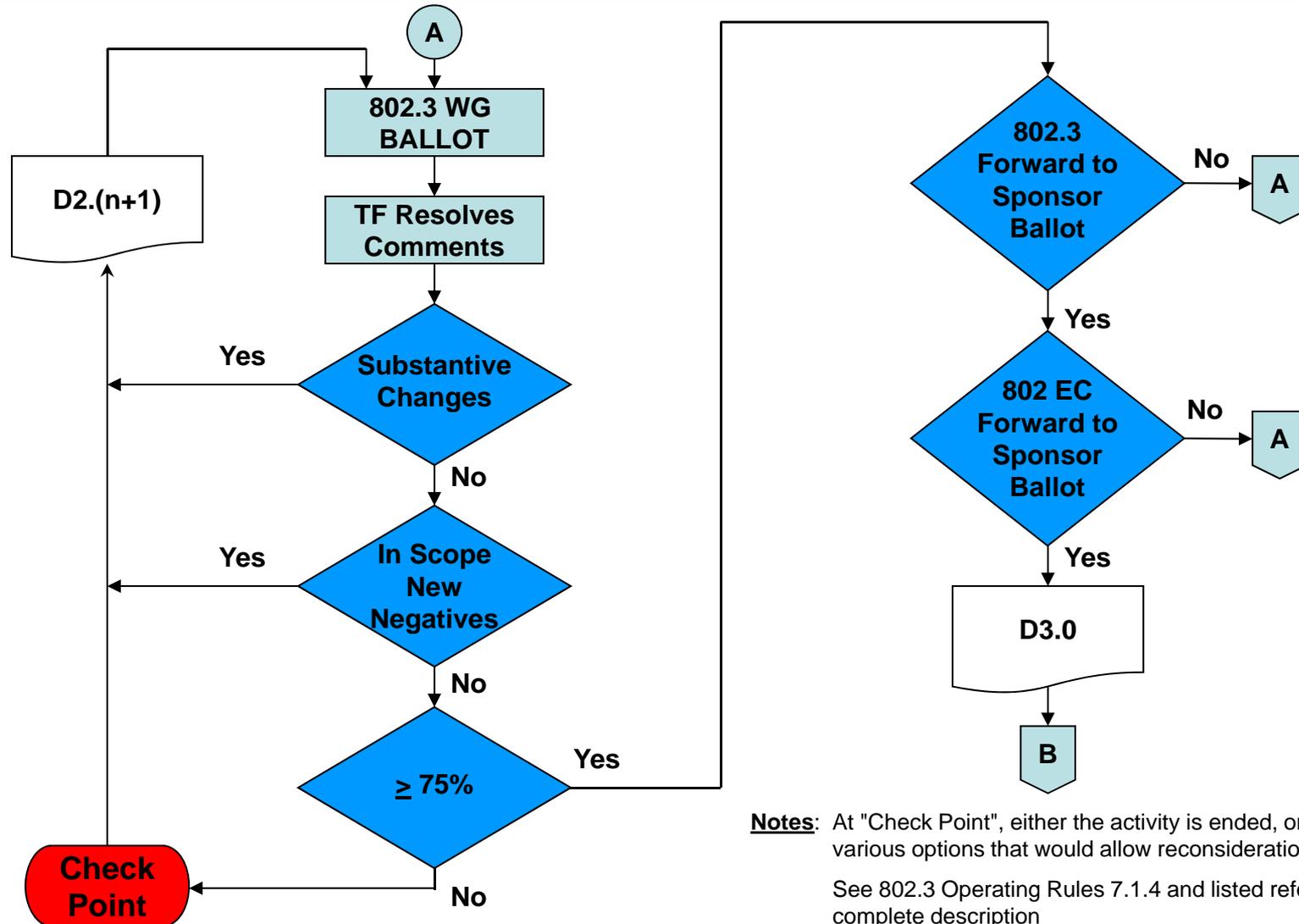


Note: At "Check Point", either the activity is ended, or there may be various options that would allow reconsideration of the approval.

Overview of IEEE 802.3 Standards Process (2/5) – Task Force Comment Phase

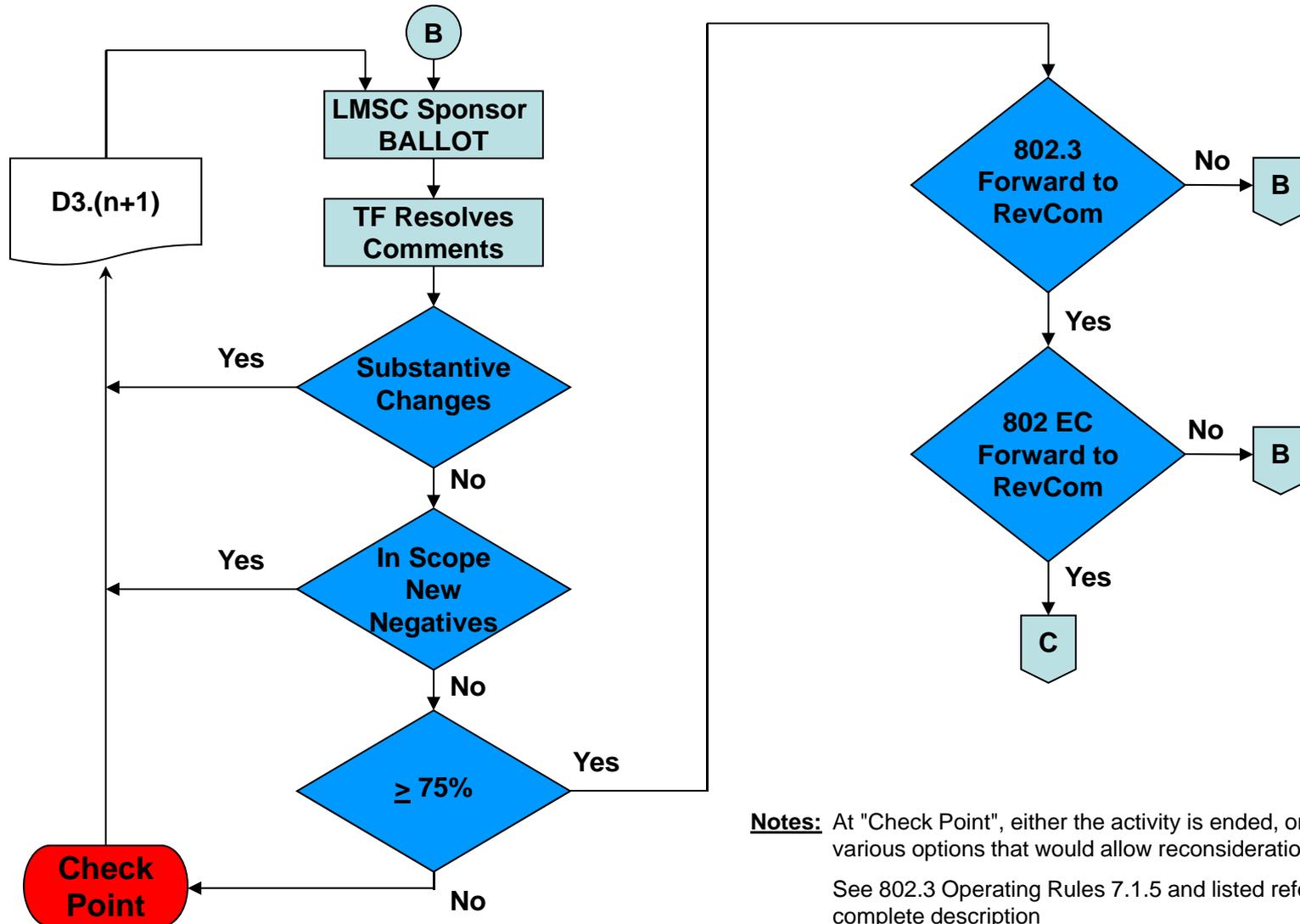


Overview of IEEE 802.3 Standards Process (3/5) – Working Group Ballot Phase



Notes: At "Check Point", either the activity is ended, or there may be various options that would allow reconsideration of the approval. See 802.3 Operating Rules 7.1.4 and listed references for complete description

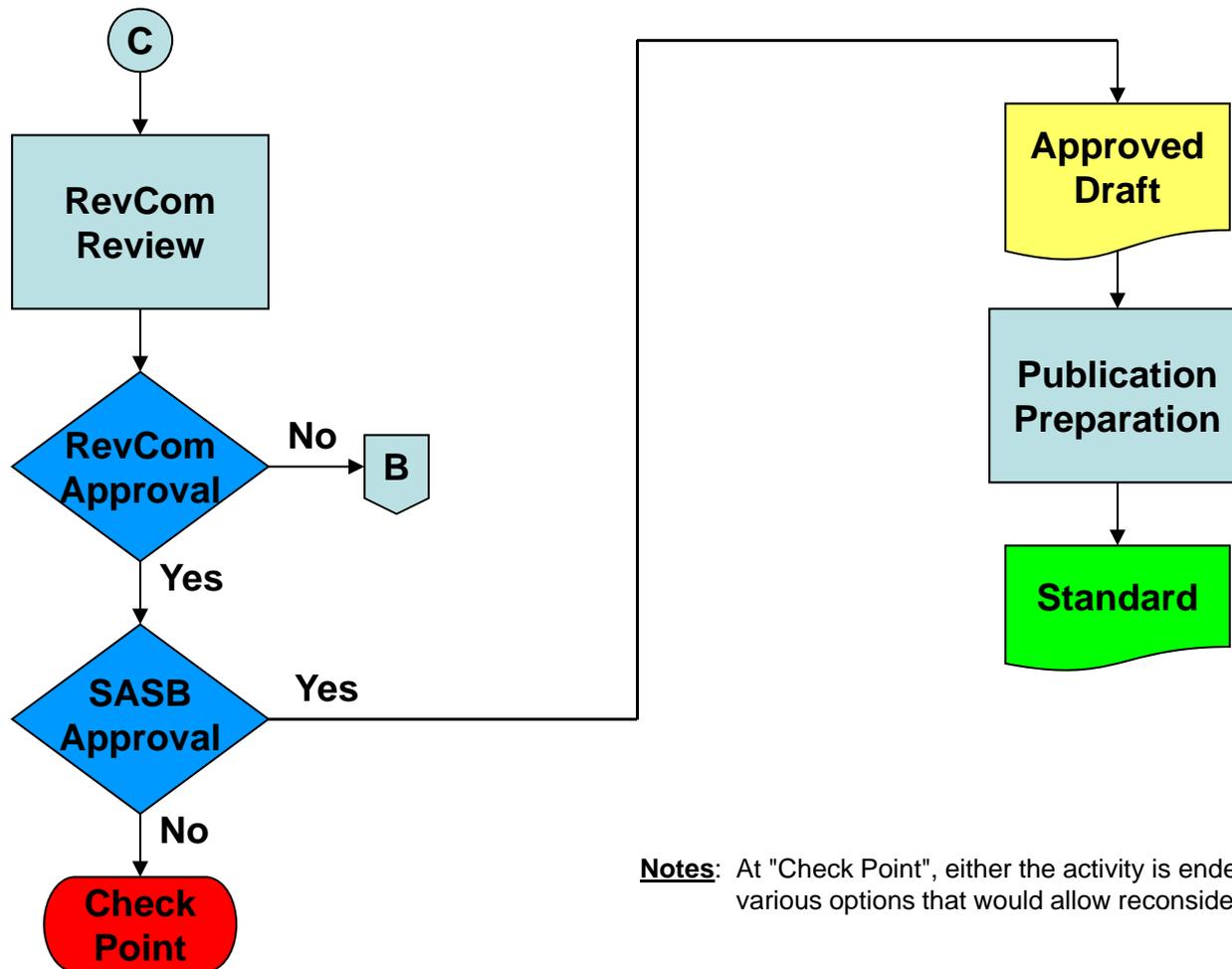
Overview of IEEE 802.3 Standards Process (4/5)- Sponsor Ballot Phase



Notes: At "Check Point", either the activity is ended, or there may be various options that would allow reconsideration of the approval.

See 802.3 Operating Rules 7.1.5 and listed references for complete description

Overview of IEEE 802.3 Standards Process (5/5) – Final Approvals / Standard Release



Notes: At "Check Point", either the activity is ended, or there may be various options that would allow reconsideration of the approval.

Liaisons and Communications

- None received

Recap of last meeting

- Heard 22 presentations
- Adopted 6 objectives
- Adopted text of 5 Criteria responses as the basis for further work

Objectives (1/4)

- Specify a PHY to support subscriber access networks using the EPON protocol and operating on point-to-multipoint RF distribution plants comprised of all-coaxial cable or hybrid fiber/coaxial media.
 - Y: 45 N: 0 A: 0

Objectives (2/4)

- Maintain compatibility with 1G-EPON and 10G-EPON, as currently defined in IEEE Std. 802.3 with minimal augmentation to MPCP and/or OAM if needed to support the new PHY.
 - Y:41 N:0 A:2

Objectives (3/4)

- PHY to support symmetric and asymmetric data rate operation.
 - Y: 40 N: 0 A: 1
- PHY to support symmetric and asymmetric spectrum assignment for bidirectional transmission.
 - Y: 42 N: 0 A: 0
- PHY to support independent configuration of upstream and downstream transmission operating parameters.
 - Y: 44 N: 0 A: 0

Objectives (4/4)

- PHY to operate in the cable spectrum assigned for its operation without causing harmful interference to any signals or services carried in the remainder of the cable spectrum
 - Y: 43 N: 0 A: 0

Broad Market Potential (I)

“Broad sets of applicability”

- The proposed project would result in a new PHY with the widest possible applicability
- Given the success of DOCSIS-based services, service providers are looking for cost-effective, high performance means to provide higher data capacity, addressing their growing CapEx and OpEx, market competition and future-proofing their existing coaxial plant, while expanding service portfolios for business and residential customers.
- Service providers have seen an unabated growth in both offered capacity and consumption of broadband IP services over the course of over 15 years for residential and recently business services

Broad Market Potential (II)

“Multiple vendors and numerous users”

“Balanced costs (LAN versus attached stations)”

- Interest and support from a worldwide array of operators, system vendors, optical and RF component manufacturers, and silicon suppliers has already been achieved
- The proposed project will result in the use of the existing EPON architecture-by extending its capabilities to support point-to-multipoint access networks using mixed fiber-optic and coaxial cabling technologies
- This approach will allow the project to optimize the cost balance between the network infrastructure components and attached stations in the cable network
 - Y: 42 N: 0 A: 0

Compatibility (I)

...“Compatibility with IEEE Std 802.3”

- As an amendment to current IEEE Std 802.3, the proposed project will remain in conformance with the IEEE 802 Overview and Architecture, as well as the bridging standards IEEE Std 802.1D and IEEE Std 802.1Q.
- Moreover, the proposed project will build on 1G-EPON and 10G-EPON architecture, extending coverage of EPON Multi Point Control Protocol (MPCP) to mixed outside plant, comprising optical fiber and coaxial cable.

Compatibility (II)

“Conformance with the IEEE Std 802.3 MAC”

“Managed object definitions compatible with SNMP”

- The proposed amendment will conform to the full-duplex operating mode of the IEEE 802.3 MAC, as defined in Annex 4A
- EPoC will reuse the MAC Control and OAM as defined in the current IEEE Std 802.3 for EPON with minimal augmentation, if necessary, while developing new specifications for PCS, PMA and PMD layers.
- The project will include a protocol independent specification of managed objects with SNMP management capability, provided by IEEE Std 802.3.1-2011.
 - Y: 40 N: 0 A: 1

Distinct Identity

“Substantially different from other IEEE 802 standards”

“Substantially different from other IEEE 802.3 specifications/solutions”

“One unique solution per problem (not two solutions to a problem)”

“Easy for the document reader to select the relevant specification”

- There is no existing 802 standard or approved project appropriate for operation at up to 10 Gb/s over point-to-multipoint mixed outside plant comprising fiber-optic cabling and coaxial cabling topologies, in symmetric and asymmetric configurations.
- The proposed project is an evolutionary extension of the coverage of EPON Multi Point Control Protocol (MPCP) and MAC, specified for IEEE Std. 802.3 **E1**PON, onto hybrid fiber-coax networks
- New PHY will be designed for operation at the data rate of up to 10 Gbit/s in symmetric and asymmetric configurations
- The proposed amendment to the existing IEEE Std 802.3 will be formatted as a set of new clauses and changes to existing clauses, making it easy for the document reader to select the relevant specification.

– Y: 41 N: 0 A: 0

Slide 31

- 1 We'll have to get back to this
Salinger, Jorge, 3/14/2012

Technical Feasibility (I)

“Demonstrated System Feasibility“

“Proven Technology”

“Confidence in reliability”

- Widely deployed data transport technology in the form of DOCSIS & Digital Video services demonstrates the capacity of coaxial networks to support multi-gigabit/second data rates over existing infrastructure when sufficient spectrum is allocated.
- Wideband communication techniques can provide necessary granularity and flexibility of bandwidth assignment in upstream and downstream.
- Millions of successfully deployed and operating 1G-EPON & 10G-EPON devices clearly demonstrate the reliability factor of MAC and PHY layers standardized by 802.3.
- Millions of Cable Modems deployed and operating demonstrate the reliability of high speed data over access cable plants.
 - Y: 43 N: 0 A: 0

Economic Feasibility (I)

“Known cost factors, reliable data”

- The cost factors for EPON components and systems are well known and there is a broad and healthy industry ecosystem associated with these technologies.
- EPoC components are expected to be similar to those used in EPON, and CNU's developed for RF networks should have comparable, or perhaps lower over time, cost structure as EPON ONUs
- The proposed project might introduce new cost factors which can be quantified and accounted for during the course of the project.
- EPON cost evolution should be directly related to future EPoC cost trends under comparable volumes.

Economic Feasibility (II)

“Reasonable cost for performance”

- EPON has been established as an attractive access technology in terms of cost/performance, capable of operating at 1 Gbps and 10 Gbps speeds.
- This project is intended to bring these benefits to RF access networks comprising a combination of fiber and coax cable.
- EPoC is expected to follow the same cost/performance trend line, established for all major Ethernet technologies developed by 802.3 in the past.
- The resulting PHYs will combine a proven, well-known point-to-multipoint network architecture of EPON with mixed outside plant comprising fiber and coax cable to address known cost/performance limitations of other access technologies.

Economic Feasibility (III)

“Consideration of installation costs”

- Installation costs, as well as maintenance and operations costs for the new technology, are expected to be similar when compared with DOCSIS equipment.
 - OLT costs are generally lower than DOCSIS CMTS costs, but installation costs should be comparable
 - CNU costs are expected to be similar to DOCSIS cable modem costs, and installation costs should be comparable
 - Additional outside plant equipment costs should be comparable to other hybrid fiber-coax equipment capital and installation costs
- A combination of high equipment production volumes, broader competition, and simplicity thanks to reuse of EPON protocols and system-level operating principles should further contribute to reduction of equipment and installation costs, especially as compared to existing DOCSIS equipment costs
 - Y: 42 N: 0 A: 0

Presentations - Tuesday

Presenter	Company	Title	Dur.	Start
Howard Frazier	Broadcom	Agenda and General Information	0:45	9:00 AM
Sam Chernak	Comcast	Economics of EPoC	0:30	9:45 AM
Jorge Salinger	Comcast	Two Physical media	0:30	10:15 AM
Break			0:15	10:45 AM
Rick Li	Cortina Systems	To bridge or to repeat in an EPOX network	0:30	11:00 AM
Nicola Varanese	Qualcomm	EPoC Architecture Considerations	0:30	11:30 AM
Ed Boyd	Broadcom	EPoC Architecture Choices	0:30	12:00 PM
Lunch			1:00	12:30 PM
Steve Shellhammer	Qualcomm	Technical Feasibility of EPOC Time Division Duplex (TDD) Mode	0:30	1:30 PM
Juan Montojo	Qualcomm	EPoC Resource Allocation	0:30	2:00 PM
David Barr	Entropic Communications	Introduction to TDD	0:30	2:30 PM
David Barr	Entropic Communications	Feasibility of a TDD Mode in EPoC	0:30	3:00 PM
David Barr	Entropic Communications	Passive Coax Media	0:30	3:30 PM
Break			0:15	4:00 PM
Leo Montreuil	Broadcom	EPoC Modulation Orders	0:30	4:15 PM
Thomas Kolze	Broadcom	Considerations and Recommendations for EPoC Error Performance	0:30	4:45 PM
Ed Boyd	Broadcom	EPoC Technical Feasibility, Part 2	0:30	5:15 PM
Recess for the day				5:45 PM

Presentations - Wednesday

Presenter	Company	Title	Dur.	Start
Mark Laubach	Broadcom	Task Force work load and diligence on proposed extra effort	0:30	9:00 AM
Juan Montojo	Qualcomm	Additional EPoC Objectives	0:30	9:30 AM
Kevin Noll	Time Warner Cable	Proposed Objectives	0:30	10:00 AM
Break			0:15	10:30 AM
Jorge Salinger	Comcast	5 Criteria	0:30	10:45 AM
Steve Shellhammer	Qualcomm	PAR wording	0:30	11:15 AM
Lunch			1:15	11:45 AM
Discussion and Motions			2:30	1:00 PM
Motions relating to Objectives				
Motions relating to 5 Criteria				
Break			0:15	3:30 PM
Discussion and Motions (continued)			2:15	3:45 PM
Motions relating to the PAR				
M.O.A.M.				
Future Meetings				
Any other business				
Adjourn				6:00 PM

Future Meetings

- See: <http://www.ieee802.org/3/interims/index.html>
- July 2012 Plenary
 - Grand Hyatt Manchester
 - San Diego, CA
 - July 16-17
- September 2012 Interim
 - ITU-T
 - Geneva, CH
 - September 24-28
- If anyone is interested in hosting a meeting, you must contact me or Steve Carlson

Future Meetings

- Straw polls:

I will attend the July plenary ____

I probably will attend the July plenary ____

I probably will not attend the July plenary ____

I will not attend the July plenary ____

Thank You!