802.3bn EPoC Ad-hoc Multiple Modulation Profile (MMP)

We'll wait a few minutes for people to join the bridge – please stand-by

April 11, 2013

Jorge Salinger, Comcast – Chair

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 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.

(Optional to be shown)

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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

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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

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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

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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.

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Agenda

- Attendance
- Review IEEE Patent Policy
- Discuss next steps to drive to baseline proposal
  - What are the items that need to be decided upon?
- Discuss what can be decided now and what has to wait
  - Identify dependencies

MMP Baseline Decisions

MMP Overview

- Multiple Modulation Profiles will be used in the bursting downstream PHY (TDD) and in the bursting upstream PHY (TDD and FDD).

- MMP allows a CNU to receive and transmit at a profile defined by the CLT that allows the most efficient bit loading and throughput, based on CNU channel characteristics.

- If channel characteristics improve or degrade, a CNU can be moved to another profile where it will perform better.

Questions to be answered in the baseline proposal (1)

- Burst Signaling
  - How do we convey to the CLT the MP of the US burst
  - How do we convey to the CNU the MP of the DS burst
  - How do we convey the begin and end of a burst at a given modulation
- Modulation Profile Support Scaling
  - How many US modulation profiles does a CLT have to support simultaneously?
  - How many DS modulation profiles does a CLT have to support simultaneously?
  - How many DS modulation profiles does a CNU need to support simultaneously?
  - How many DS modulation profiles does a CNU need to store for use?
  - How many US modulation profiles does a CNU need to be able to transmit in at any given time? 1
- Modulation Profile Definition
  - What parameters are defined within a Modulation Profile?
  - Define MCS used within each profile
  - Can more than one MCS be used within a resource block?
    - Need to understand size of the resource block.
  - How many MCS may be used per profile?
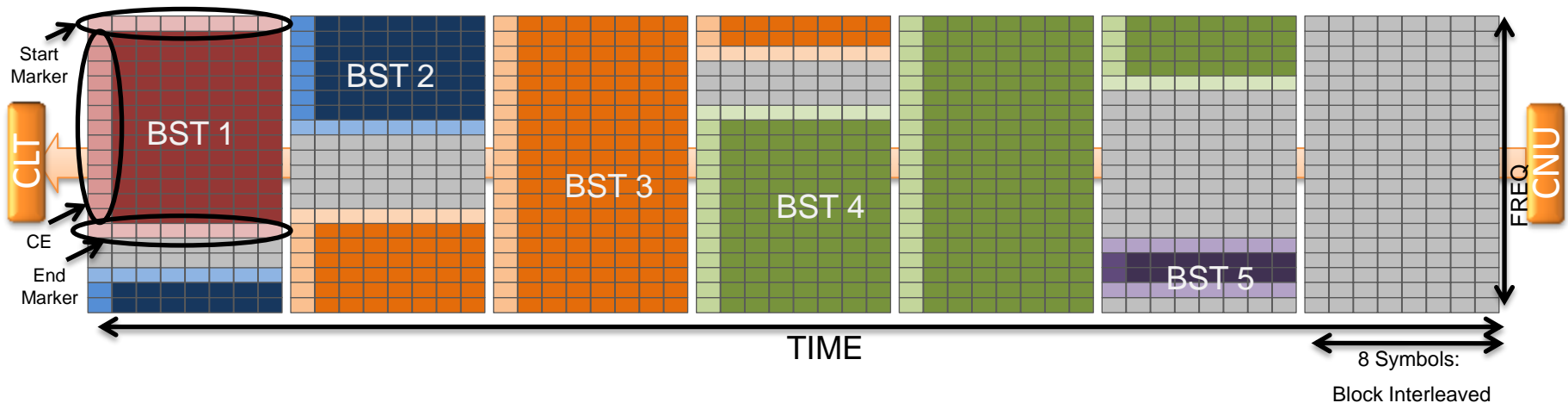 - Within a profile, what parameters are static and which can be changed?

Questions to be answered in the baseline proposal (2)

- Modulation Profile Assignment
  - How is the modulation profile a CNU should use for rx/tx be communicated initially?
  - How does the profile that a CNU is using get changed?
  - Hitless movement between profiles for the CNU?
- Multicast
  - Do we need multicast LLIDs, like DOCSIS 3.1?
  - Does multicast go on the LCD LLID?

Burst Signaling

Upstream Burst Marker

- The exact carrier of a burst start is determined by the "Start Burst Marker".
- The exact carrier of a burst end is determined by the "End Burst Marker".
- The number of empty carriers between bursts is unknown due to discovery, idle upstream, or slight upstream jitter in the MAC transmit slot.
- Data from the burst is decoded by FEC decoder and last block size for shortened code word is determined by the end marker.
- Burst Marker Decoding should be simple so it can be done in parallel (on all carriers) before block de-interleaver.

Start Marker

CE

End Marker

CLT

BST 1

BST 2

BST 3

BST 4

BST 5

CNU

FREQ

TIME

8 Symbols:
Block Interleaved

Burst Marker Definition

- Fixed Low Modulation Order Pattern (BPSK?)
- Easy to detect in bad channel conditions
- Simple Hamming Code to fix bit errors?
- Should be able to carry a small amount of data.
  - Profile ID that identifies the modulation profile used.
  - Different marker for each profile.
  - Distinct marker for start and end.
- Multiple Carriers for robustness?
- How can it be unique from normal data?
- Could we use a slightly different Channel Estimation Code or Pilots to signal the marker?

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US Burst Characteristics
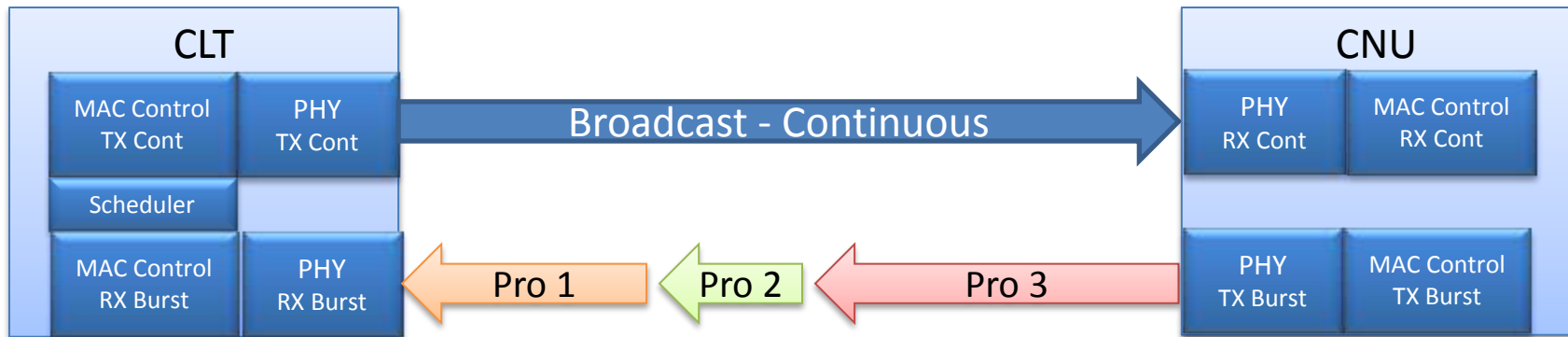
- Upstream Bursts contain packets for a single modulation profile since they come from a single CNU. (Packet sorting is not required)
- Upstream Bursts will always end the FEC block so there is no additional penalty for shortened code words.
- Every CNU would store a single modulation profile for the upstream.
- CNUs on different profiles would have a different conversion equation from Byte to TQ. Only one conversion needed.
- CLT PHY needs to detect and decode multiple profiles.

CNU PHY should be simple, CLT PHY is more complex

Modulation Profile Scaling

Modulation Profile Scaling

- Minimum number of US Profiles the CLT has to support:

- Minimum number of DS Profiles the CLT has to support:

- Minimum number of DS Profiles the CNU has to support: 2(LCD and optimal?)

- Minimum number of US Profiles the CNU has to support: 1 (?)

Modulation Profile Definition

Modulation Profile Definition

- # US Modulation Profiles:

- What parameters are included in a modulation profile?

  - Modulation coding schemes (modulation order) and which resource blocks they apply to.

  - Pilot pattern?

  - FEC?

  - Time interleaver? Could be useful due to where burst noise is on the channel. 1 per profile?

Modulation Profile Assignment

Modulation Profile Assignment Details

Multicast

Multicast Details