IEEE 802.3da – Receive Mode Collisions

Piergiorgio Beruto

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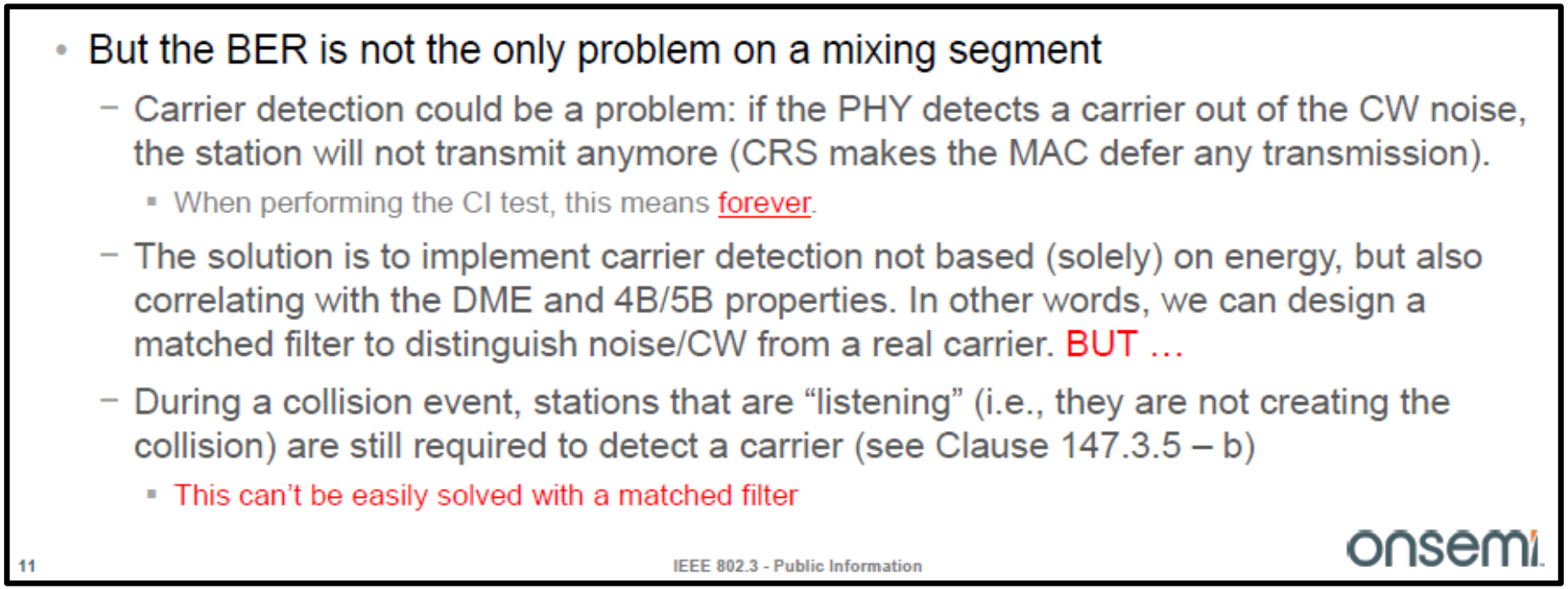
Outline

- The problem of detecting a carrier in harsh noise environments was mentioned in beruto_3da_20220711_noise_env.pdf slide #13



- But the BER is not the only problem on a mixing segment
  - Carrier detection could be a problem: if the PHY detects a carrier out of the CW noise, the station will not transmit anymore (CRS makes the MAC defer any transmission).
    - When performing the CI test, this means forever.
  - The solution is to implement carrier detection not based (solely) on energy, but also correlating with the DME and 4B/5B properties. In other words, we can design a matched filter to distinguish noise/CW from a real carrier. BUT …
  - During a collision event, stations that are "listening" (i.e., they are not creating the collision) are still required to detect a carrier (see Clause 147.3.5 – b)
    - This can't be easily solved with a matched filter

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- This presentation is meant to introduce the problem and start a discussion

Detecting a carrier event in harsh noise environments

Problem Statement

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Overview

- Detecting a carrier is one of the fundamentals of CSMA/CD, i.e.,
  - A station **defers** any transmission until the line is “free”
    - The PHY is responsible for detecting and reporting a carrier event to the RS and the MAC
  - Multiple stations *may* initiate a transmission “at the same time”, resulting in a collision
  - Collisions are handled by the MAC by backing off and re-trying TX after a random time
  - *That’s what happens normally when two or more people talk!*
- The problem lies in the definition of “line free”
  - The “intention” is to detect a carrier (line busy) when another station is transmitting
  - But what happens when the line is very noisy?
  - If you detect the noise as a carrier event, you’re basically waiting for the noise to end
    - may be acceptable, if you know the nature of the noise and that it’ll end at some point
  - But if the noise is just part of the environment you’re in… you’d defer TX forever!
    - Back to the example of people talking, if they are in a noisy room, they would want to speak louder instead of stop talking. Unless… they have some means to filter the noise out!
      - That’s what Clause 147 PHYs do already → using a matched filter relying on DME and 5B properties

What's the catch?

- If you have only two stations on a mixing segment, the matched filter technique works just fine
- But If you have multiple stations that can collide, stations that are not participating in the collision want (in principle) to defer any TX until the collision is over
  - That is, detecting a carrier
    - **This is called a "receive-mode collision" (which is not about detecting the collision!)**
      - **The Clause 4 MAC does not react on the PLS_SIGNAL primitive (MII COL) when not transmitting**
    - Clause 147.3.5-b requires the PHY to detect a carrier during a receive-mode collision
- But can you really distinguish noise from a carrier event resulting from collisions?
  - This can be a very complex operation and may not even be feasible in some cases
  - **Not a problem if you're using PLCA (collisions are prevented)**
  - May be a problem for non-PLCA systems and for D-PLCA startup

What's the effect of detecting receive-mode collisions?

- Detecting a carrier during a collision event, prevents listening nodes from joining the collision
  - That improves the performance, especially when the number of nodes on the mixing segment is high
  - But in principle, it is not a problem if the PHY fails to detect a carrier in this case
    - As soon as the PHY joins the collision, it will detect the collision and report it to the MAC as normal
    - The number of nodes we're considering for 802.3da is low compared to 10BASE-2 and 10BASE-5
      - Also, no repeaters have been defined for 10BASE-T1S/M
    - When using D-PLCA, nodes eventually get a unique ID assigned, then collisions are avoided
      - At startup, or when nodes join/leave the network, collisions may happen
- Can clause 147.3.5 requirement be relaxed to allow a PHY to (statistically) not report a carrier event during a collision?
  - The PHY ~~shall~~ should assert CRS in the presence of a signal resulting from a collision between two or more other stations.
- Some corner cases require attention
  - Discussed offline in a restricted group

Conclusions

Conclusions

- In harsh noise environments reliably detecting a carrier can be very difficult during a receive-mode collision event
- Clause 147.3.5 requires the PHY to assert a carrier in that case
- Relaxing this requirement is desirable for not precluding the PHY to operate in industrial, building and transportation noise environments
- The downside of not detecting receive-mode collisions is a decreased throughput/bandwidth (it may create more collisions)
- Corner cases are also under discussion
- Propose to setup an ad-hoc call to discuss these cases further

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