**Comments from TON reviewers and our recommended actions**

My general comments on the reviews

* We have to make a more detailed study of the coexistence scenario.
* We should find a way of implementing hidden nodes.
* We should imagine network topologies with different rates, that is, with different transmission durations.
* Compare with CSMA/CA+FS.
* Schedule Reset is a must in this paper.

**Note**: only relevant comments are highlighted. Spellchecks and simple clarification are taken into account but not shown in this document.

Reviewer 1

@ Abstract:

1. Change “totally distributed” for “fully distributed”.

@ Introduction:

1. “What would be useful in the Introduction to specifically mention, is whether the proposed CSMA solution performs well when co-existing [perhaps with more greedy?] legacy CSMA/CA clients. The authors mention that throughput improves in co-existance scenarios, but it should be clear that it is not at the cost of better throughput for the nodes that are operating using the authors' proposed CSMA solution. This leaves less room for reader drifts.”

We should pay more attention to the coexistence test. The Schedule Reset mechanism may provide the necessary aggressiveness required to outperform CSMA/CA stations without degrading their throughput. **The coexistence test is crucial.**

1. An implementation is crucial as well as the use of a measurement-based simulation environment. Good work. Mention in the introduction that the simulation is based on the COST simulation environment for greater credibility.

Should we have to write Francesco’s paper at the same time and attempt to incorporate its results through a reference to it?

@ Related Work:

1. When stating the size N of collision slots, and that solutions that adopt such policies do not take care of situations where the number of nodes M > N, please give an example value for N. What number of M are we looking at? And is it reasonable to make the argument that M > N? If N is large as it is, then the concern is not that M > N, but really can we service that many nodes? (at least not [reasonably] today) Perhaps a simple footnote could help clarify this.

Just a simple clarification may suffice.

The case of M > N; where M are nodes and N is the biggest deterministic schedule, is very unlikely at the date of writing. For this to happen there should be >511 nodes in the network. We can prepare a figure with this value of M and see how the throughput keeps decreasing due to a huge time between successful transmissions.

@ Section III:

1. It would be useful if the authors include a table with a list of important notations. Would help with readability.
2. Section III.B, the aggregation process should be explained in more detail. Is the aggregation here similar to that used in 802.11n, where the level of aggregation depends on the transmission rate? How are packets aggregated? It is then mentioned in Section III.C that the packet is an MPDU and other details that indicate this protocol is applied for 802.11n+. Please clarify these details before then.

Yes, we must clarify the use of A-MPDU aggregation and why Fair Share is the way it is. Maybe more explanation of CSMA/ECA extensions (as in the Research for Standard) is needed, as well a results of CSMA/CA+FS?

1. It is not clear in Section III.C what the authors mean by the "inferior" backoff stage. Please clarify or replace with a more descriptive word. Perhaps: subsequent, later, following, etc.

@ Simulation:

1. The use of the COST model is very relevant in this case, for a more realistic simulation evaluation environment

What does he mean here? The structure of the simulator?

1. The component lines in Figure 9 are not clear. They overlap. Perhaps in all graphs, align the legends with the order of their corresponding results. For example, the first legend item corresponds to the largest result (as in Figure 10). Also, this reader suggests to add a major line to separate the two parts of Figure 9 for more clarity --- this applies to other figures too. Also, more discussion on the values for the average backoff stage. What do large/small values mean? What kind of best pattern are we looking for? Results aren't as intuitive as other metrics.

Although it seems complicated, the reviewer simply suggests consistency in the figures and further explanations. These explanations seem to be fairly easy.

If there is a desired value that would be the one that approximates closest to the number of nodes being simulated. That is, it there are 16 nodes, the desired k would be k = 1, because Bd = 2^1\*CWmin /2 -1 = 15; where CWmin = 16.

1. A little more detail on the peak values at around 35 nodes for the proposed solution. In Figure 15 and 16, it appears as if 35 nodes would be the worst-case scenario for a network to remain in. Some explanation on how the dropped packets (or collision slot) increase is a temporary result before the network re-calibrates and that values in the long-run look more like the values for other N values.

We should analise the dropping of packets in the non-saturation case. Maybe we can take a look at the backoff stage of the nodes? In summary, we should reveal the cause of the dropping of packets.

An initial idea relates to the doubling happening at this amount of nodes. The deterministic backoff should be changing from 32 to 64 in 25 < N < 60. This provokes an increase in the number of collisions, disruption of collision-free schedules and a forced reconvergence with higher backoff stages. Can this lead to dropping of frames and this high % of collisions?

1. This reader appreciates the level of thought and detail that was put into presenting these graphs. I think the authors could improve on the explanation of the results, as there are quite a bit of very interesting results and graphs presented. The explanation is quite good as is, but it often reads as a teaser, with a need for a little more detail to close the loop.

I think we would also appreciate a better explanation of what “more detail” means, ;).

@ Other:

1. The authors did not discuss the impact of such things as hidden terminals on system performance (such as those discussed as early as [3]). Can the authors give insights on why that is the case? Perhaps a discussion outlining how this problem is out of scope, how it would possibly not impact performance results, how it is covered in other works... Some discussion to this avail. However, if space is a limitation, I would prefer the authors focus on deeper discussion of the results, rather than this discussion. Some mention or brief insight though would be appreciated.

Maybe we should pay more attention to the hidden terminals?

My view of the effect of hidden terminals in a simulation with a perfect channel is more of less the same as a simulation with a imperfect channel. That is, hidden nodes will cause disruptions of collision-free schedules, but once they are able to transmit successfully, at least in theory, they will join the collision-free schedule.

Reviewer 2

@ Weaknesses:

1. The simulation results are obtained under simplistic scenarios where all nodes are within communication range and assuming perfect physical layer with no interference or channel errors.

I think we can do something about this. We already have a mechanism for mimicking channel errors, as well as slot drifts.

About PHY, we may also vary the duration of the transmissions. Maybe we can come up with a way of a network with different rates. I’m confident that results won’t vary in shape.

1. The proposed scheme is only compared against CSMA/CA

Should we implement L-MAC or Z-MAC, for instance? I think I can do it fairly quickly in COST.

1. The authors do not propose a solution for the additional delays that may arise from Fair Share, which can be detrimental to time sensitive traffic.

I think the Schedule Reset mechanism can be a solution to this problem.

The problem of rapidly arriving at the maximum backoff stage is also related to this. If we are able to successfully reduce the schedule (via Schedule Reset), we can also lower the level of aggregation to the minimum possible for each node (given the information it has on the channel).

At the moment we have two options for reducing the schedule, those are: halving it or the aggressive approach of finding a deterministic schedule between the node’s own transmissions. Both approaches can be adjusted to increase or decrease its aggressiveness by varying the number of transmissions needed for changing the schedule.

About adjusting the aggressiveness: in the experimental results we used the more aggressive approach. So we assumed the tradeoff between collisions and throughput.

@Detailed Comments:

1. The simulation assumes that all nodes are in communication range and there is no external interference and channel errors. This is not true in real world scenarios. Furthermore, they are likely to have an impact on the protocol performance. In the presence of channel errors, all packet drops due to channel error are going to be treated as collision by the protocol. This will result in increased backoff and with deterministic backoff the nodes will get stuck with large backoffs even if there are only a few nodes in the network.

This is true. That’s why we propose the Schedule Reset

1. This is likely to add unnecessary delay to data transmission. The authors can add a more detailed physical layer simulation which uses real channel traces or IEEE TGn Channel models to simulate a more realistic channel and see how channel errors impact delay. It would also be useful to see results for different topologies e.g. line topology, grid topology etc. and also for scenarios in which all nodes are not in communication range.

We have to think on a way of doing this with COST. The NS-3 implementation of CSMA/ECA (that may support this topology tests and better channel implementations) has already been done in Brescia.

Nevertheless, its only a matter of finding a way of implementing all of these fixes in COST.

1. The proposed scheme is only compared against CSMA/CA. It would be beneficial to see how CSMA/ECA performs in comparison to other proposed zero collision schemes like Zero Collision MAC (ZC-MAC) and Learning MAC, which are referred to in the related work section of the paper.

We should implement them.

Reviewer 3:

@Weaknesses:

1. The related work section needs update. The discussion only includes two other studies, which is insufficient.

Ok

1. The major contributions of this paper come from the two extensions, which is probably not enough considering the journal.

Maybe by introducing more complex scenarios and the other enhancements required by Reviewer 2, when can have a complete proposal.

1. The difference between this submission and the conference/workshop version is not sufficient. The differences are mainly in evaluation part.

So maybe we can evaluate more extensively?

1. Moreover, the Algorithm does not consider decreasing k, which decreases the contribution of the paper and backward compatibility.

Schedule Reset does.

@Major Comments:

1. The related work section discusses two MACs in a nice detailed way. However, a more comprehensive related work discussion on CSMA/CA is desired
2. The reviewer is interested in Fig. 2. As described in Fig 1 and Algorithm 2, when N is less than B\_d, the schedule will be collision-free. It should look something like this.

     STA 1:  7   6   5   4   3   2   1   t

     STA 2:  3   2   1   t   7   6   5   4

     STA 3:  4   3   2   1   t   7   6   5

     STA 4:  2   1   t   7   6   5   4   3

     STA 5:  t   7   6   5   4   3   2   1

     STA 6:  6   5   4   3   2   1   t   7

     STA 7:  1   t   7   6   5   4   3   2

 where each value is the amount of empty slots before the backoff expires and t denotes success and send.

 So, when 2 < N < 7, each node can send at most 1/8 of the slots. Shouldn't the aggregated throughput of N = 3 be around 1.5 times to the aggregate throughput of N = 2? The reviewer has similar question for later figures regarding to throughput.

Empty slots causing a reduction in the aggregated throughput?

Is it because some other factors (such as SNR) are considered? The reviewer understands that when there are more contenders, there are more collisions and the aggregate throughput decreases when the number of contender increases. However, the aggregated throughput for small N is confusing the reviewer.

We may need to discuss this. Shall we get deeper into this? Confused.

1. It is clear that Fair Share is to solve the uneven partition caused by Hysteresis. However, k never decreases and it only increases, (at least not shown in Algorithm 3.) A mechanism for decreasing k is needed. Otherwise, k is likely to grow to m = 5 and result in fixed m long waiting time. For example, if k grows to 5, which only requires 5 collisions, the node attempts to send 32 packets every (2 ^ 5 \* 16)/2 - 1 = 255 slots. 5 collisions might not happen in simulations with pure CSMA/ECA\_{Hys+FS} nodes. However, as this paper suggests, backward compatibility is important. A legacy CSMA/CA can easily contribute 5 collisions to other CSMA/ECA\_{Hys+FS} nodes. On the other aspect, node (even CSMA/ECA\_{Hys+FS} nodes) addition might also introduce unexpected collisions that raise k. If k reduction does not exist, it seems to the reviewer that CSMA/ECA\_{Hys+FS} will eventually converge to CSMA/ECA\_{Hys+ArgMax}.  Moreover, a mechanism for reducing k is also helpful for node removal. Finally, clock drift might also contribute to some collisions. Therefore, the algorithm needs a way to decrease k to make it realistic.

True. That’s why Schedule Reset exists.

1. What is the behavior for non-saturated nodes? When their queue is empty, do they reset their r, k ... everything?

Yes. We should make it clearer.

1. Possible typo at the fourth last line of Section II-A, "Additionally, Z-MAC ..." -> "Additionally, ZC-MAC ..."
2. At the first line of the third paragraph of Section II-B, "L-MAC ..." L-MAC is obviously Learning-MAC, but the term "L-MAC" used without defining.
3. Please consider relocate figures and algorithms to locations before they are referred. It will improve readability significantly.

Thanks, very important for readability.

1. Please consider editing the first sentence of Section III-C. "They ..." What are they?
2. Although the paper is nicely written, the structure of the paper is weird. A short Section IV for describing simulation setting may be merged with Results section.
3. Another idea comes to the reviewers mind. If k and CW\_min can be adjusted smartly, for sparse scenario, is the following schedule possible?

     STA 1:  1   t   1   t

     STA 2:  t   1   t   1

i.e., k == 0 and CW\_min == 0. (The reviewer might be wrong.)

Yes it is. At least in theory.

1. At the third line of the third paragraph of Section VI. "... comercial ..." -> "... commercial ..."
2. The reviewer is interested in the k values in high contention scenarios. If not too difficult, please make figures for k, especially when CSMA/ECA\_{Hys+FS} co-exist with CSMA/CA. Does CSMA/CA nodes cause collision and increases k? If not, why not?

Yes, k will be increased a lot, and maybe Schedule Reset may allow CSMA/ECA nodes to reduce their schedule. We should have more data for mixed scenarios.