IEEE P802.11  
Wireless LANs

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| ARC SC teleconferences minutes May 2021 Plenary | | | | |
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Abstract

This document contains the minutes of the IEEE 802.11 ARC SC teleconferences during the March 802.11 Plenary meeting, held on 10 May 2021 at 13:30-15:30 h ET and 12 May 2021 at 11:15-13:15 h ET.

Note: Highlighted text are action items. A- precedes comments from the document’s author, C- precedes comments, R- precedes responses to comments.

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# Monday 10 May 2021 at 13:30-15:30 h ET

## Administration:

**Chair: Mark Hamilton, Ruckus/CommScope**

**Vice Chair: Joseph Levy, InterDigital**

**Secretary: Joseph Levy, InterDigital**

**Meeting called to order by the Chair 13:02 ET**

Agenda slide deck:[11-21/0611r1](https://mentor.ieee.org/802.11/dcn/21/11-21-0611-01-0arc-arc-sc-agenda-may-2021.pptx) will be r2 out of the meeting.

**Call for Patents:**

The Chair reviewed the Patent policy and called for potentially essential patents – there was no response to the call.

**IEEE WG meeting guidelines:**

The chair reviewed the IEEE SA guidelines.

**IEEE SA Copyright Policy:**

The chair reviewed the Copyright policy.

**Participation:**

The chair reviewed the participation policy.

**Approval of the Agenda:**

* **Reminder: 2 meetings this week: Monday 13:30 ET, Wednesday 11:15 ET**
* **Attendance, noises/recording, meeting protocol reminders**
* **Policies, duty to inform, participation rules**
* **Prior meeting minutes**
* **Contribution/discussion topics:**
  + **802.11 TGbe’s evolving multi-link architecture contributions**
  + **If enough time: Annex G way forward (including, especially, for TGbe and REVme’s integration of 11ax)**

The Chair reviewed the agenda and called for comments or amendments to the agenda - there was no response to the call.

The proposed agenda was accepted without comment.

Approval of the Minutes was deferred to Wednesday, as they were only just posted.

Chair reviewed agenda deck slide 16 – The ARC other topics slide and discussed ongoing ARC activities. Attention was call to Annex G – will be on the agenda for the March meeting – 802.11be has asked questions regarding the need to provide Annex G text.

## Contributions:

802.11 TGbe’s evolving multi-link architecture:

* How does the architecture (still evolving) within 802.11 TGbe fit into or affect the overall (baseline) 802.11 architecture?
* Contributions:
  + <https://mentor.ieee.org/802.11/dcn/21/11-21-0396-02-00be-11be-ap-mld-architecture-discussion-2.pptx>
  + <https://mentor.ieee.org/802.11/dcn/21/11-21-0577-00-00be-cr-mld-architecture.docx>

C – [11-21/0577-r0](https://mentor.ieee.org/802.11/dcn/21/11-21-0577-00-00be-cr-mld-architecture.docx) should be presented, should it be presenting in ARC before presentation in TGbe?.

Chair – The authors may want to get ARCs opinion on [11-21/0577-r0](https://mentor.ieee.org/802.11/dcn/21/11-21-0577-00-00be-cr-mld-architecture.docx) before he presents it in TGbe, but ARC is not a gate to presentation in TGbe, the authors and TGbe will decide when it is presented in TGbe.

C by the author - A lot of the content is text; the document is a CR already submitted to TGbe and the TGbe reflector. It will be helpful to present it here. No preference as to the order of documents.

Chair – we can reverse the order of the presentations, or we can time limit the presentation of [11-21/0396r2](https://mentor.ieee.org/802.11/dcn/21/11-21-0396-02-00be-11be-ap-mld-architecture-discussion-2.pptx) to an hour.

Proceeding with [11-21/0396r2](https://mentor.ieee.org/802.11/dcn/21/11-21-0396-02-00be-11be-ap-mld-architecture-discussion-2.pptx) – Mark Hamilton presenting.

C – Legacy doesn’t need to be shown – as it is just overlaid – the way it is presented in [11-21/0577-r0](https://mentor.ieee.org/802.11/dcn/21/11-21-0577-00-00be-cr-mld-architecture.docx) seems cleaner.

C – Agreeing that the legacy is already present in the spec, no need to show it again.

C = Additional support for the two previous comments. No need to worry about legacy, we should only address non-legacy.

A – This is describing how the devices will do their addressing.

C - Maybe it should show more than an 802.11 Medium, maybe one for each channel pair.

R – Questioning if we need to show it that way – maybe changing to media instead?

R = Changing to media is too subtle.

A – Agreeing – changing to media is too subtle.

Stopped [11-21/0396r2](https://mentor.ieee.org/802.11/dcn/21/11-21-0396-02-00be-11be-ap-mld-architecture-discussion-2.pptx)

Presenting [11-21/0577-r0](https://mentor.ieee.org/802.11/dcn/21/11-21-0577-00-00be-cr-mld-architecture.docx) - Duncan Ho (Qualcomm)

This is a CR in TGbe to address some CIDs

Regarding calling the MLDs a STA and AP – this was considered, but it is easier to not do this and use the MLD terminology. Reference to 11-21/0565

There is a new section for MLO 4.9.5 –

Figure 4-xxxx Comments:

C – Why the upper dashed line? It should not be there. Also, labeling the SME SAPs would help clarify things.

A – Will consider the inputs.

C – Asking for legacy SAPs to be shown –

A – It is not necessary, as the legacy is described by the legacy spec. There is only one MAC SAP for an MLD. If we mix the behavior, it will be difficult to explain.

C – The next diagram is showing the multiple MAC addresses – how is MAC Randomization handled.

A – MAC randomization is a whole new topic.

R – MAC randomization is not an option on the AP side – it is all on the client side. And on the client side it is all before association, once you are associate you don’t change the MAC address. We only require the STA MAC address needs to be different. It is not used for the upper DS address. We should basically follow the base line. Once you decide the address everything is fixed. There is no need to say more or that this document needs to address randomization stuff.

R – If a device goes away and comes back – and has the same upper MAC address but it has different lower MAC addresses?

R – If you PS and go away and comeback you are still associated so there is no issue. But, if you go away and then comes back, you will need to renegotiate, as you would do today. This is fine, as this document is about once you are connected.

C - Before association the MAC addresses can be random – once you have associated things are not changing.

R – This may need to be addressed at some point – but probably not in this document.

R – Supporting the comments made regarding randomization – it is only pre-association. If it is changing post association, it will probably need to address it in TGbe.

C – As the TGbh chair – I need to work with the TGbe Chair to check the order and how things are dealt with.

The MAC address doesn’t define an SME.

C – We have definition of the MAC address for the MLD.

R - It could be ok – but we don’t want to say it is the SME. The MAC address identifies the SAP – so the address should identify the SAP.

R – Is the latest addition, wasn’t the SME changed to authenticator. The use of authenticator is used this way in the legacy.

R – It is weird to identify an authenticator with a MAC address.

C – Regarding the last paragraph, the legacy stacks have their own authenticator, and the group keys are handled by this legacy authenticator. Maybe a note should be added.

A – Adding a note after authenticator may work – to describe the other legacy authenticators – but there is no need to bring legacy stuff into this picture.

C - We need to be careful – because from an MLO perspective there is only one authenticator. So, we need to be very careful.

R – Are we detailing this stuff in clause 12.

R - Yes.

C – The statement “uses a different MAC address?” what does this mean.

A – It should say each of them has a different MAC address.

R – That should be better.

C – How does roaming work with these MAC addresses?

A – This document is not discussing the roaming case – we need to play tricks there. Maybe I could clarify it here by saying this does not cover the roaming case.

C – This document is only addressing the listed comments, and only addresses the connection, this is not about roaming. Roaming is address elsewhere – this allows the specification to be clear. So, we don’t put any TBDs, there are no roaming condition to be addressed.

C – Roaming is BSS transition – I think the however statement – adding the flexibility to save on allocating a MAC address – you could use the locally address bit. You could address the requirement.

C – The SME is responsible for coordinating each of the affiliated SMEs – this is confusing. In the figure there is only one SME.

A – SMEs was removed.

C – The “An AP MLD can support two or more links - ….” This sentence doesn’t need to be here.

A – the sentence was moved to the first paragraph of the clause.

C – Channel overlaps don’t have any meaning. There are no restrictions on how the channels are set up. Reduce the number of times it is said. Switch to multiple links instead of two or more.

A – change “MLO allows for operation over multiple links” and “MLD manages communication over multiple links”.

C - Concerned was expressed regarding the fairness issue – if a device has multiple radios on one channel and there are no restrictions how is fairness dealt with. Concern that this could be a problem.

R – The sentence is addressing STR and NSTR, it is ok as it is.

R – If they are physically different radios, unless they are restricted a single channel there will be fairness issues.

R – It is not possible to be STR on the same channel – unless you are full duplex – you would get nothing if they are on the same radio.

R = If there are 10 radios, only one might operate at any given time. It is hard for me to understand what is meant by STR on the same channel. STR will be on different channels – but I assume it is the case though not specified.

A – The intention of the this paragraph is an overview and address STR and NSTR – can we put these issues aside for now – this would be a more appropriate to be discussed in TGbe.

C – Agreement that this is a TGbe topic and how color is impacted and how this works is critical.

A – Reviewing the MAC sublayers and functionality of the layers.

C – Questioning PMKSA, PTKSA - how is the related to the security association. I don’t know if you need to do this in the overview.

A – It is e.g., PMKSA - The MLD has multiple links, each link has block ACK – on each link the local link will send the ACK – but the packets could arrive in different order – the upper layer needs to track this. Hence, the score boarding is at the upper layer. Everything could be done in the single link.

R – the first thing you said was score boarding over link 1 and could be reflected on to link 2.

You have an SN/PN in the lower MAC do you need it also in the upper MAC?

C – Introducing the “legacy” behavior with non-unicast data at this point in the spec is confusing and may need to be clarified.

C – The BlockACK is mandatory.

A – Score boarding in the upper MAC is critical for reordering.

C – Score boarding is an upper MAC function. If the score boarding is upper mac only, reordering is something different. Score boarding is implementation dependent. The how score boarding is divided between upper and lower MAC is implementation dependent and should not be discussed here.

C – I’m confused where the score boarding is being done?

Chair – We are out of time – we can come back to this on Wednesday if time allows.

## Recess: 15:31 h EDT

# Wednesday 12 May 2021 at 11:15-13:15 h ET

## Administration:

**Chair: Mark Hamilton, Ruckus/CommScope**

**Vice Chair: Joseph Levy, InterDigital**

**Secretary: Joseph Levy, InterDigital**

**Meeting called to order by the Chair 11:15 h ET**

Agenda slide deck: [11-21/0611r4](https://mentor.ieee.org/802.11/dcn/21/11-21-0611-04-0arc-arc-sc-agenda-may-2021.pptx)

**Call for Patents:**

The Chair reviewed the Patent policy and called for potentially essential patents – there was no response to the call.

**IEEE SA Copyright Policy:**

The chair reviewed the Copyright policy.

**Participation:**

The chair reviewed the participation policy.

**Approval of the Agenda:**

* **Attendance, noises/recording, meeting protocol reminders**
* **Policies, duty to inform, participation rules**
* **Prior meeting minutes approval**
* **Contribution/discussion topics:**
  + **Annex G way forward**
  + **If enough time: carry-over from Monday, 802.11 TGbe’s evolving multi-link architecture contributions**
  + **Other topic(s)? (See next slide)**
* **Next steps**

The Chair reviewed the agenda and called for comments or amendments to the agenda - there was no response to the call.

The proposed agenda was accepted without comment.

## Meeting Minutes Approval:

The Chair called for comments or changes to these minutes - there was no response to the call.

March plenary: [11-21/0406r0](https://mentor.ieee.org/802.11/dcn/21/11-21-0406-00-0arc-arc-sc-teleconference-minutes-march-2020-plenary.docx)

April telecons:

* + April 5: [11-21/0576r0](https://mentor.ieee.org/802.11/dcn/21/11-21-0576-00-0arc-arc-sc-teleconference-minutes-05-april-2021.docx)
  + April 8: [11-21/0630r0](https://mentor.ieee.org/802.11/dcn/21/11-21-0630-00-0arc-arc-sc-teleconference-minutes-08-april-2021.docx)
  + April 26: [11-21/0733r0](https://mentor.ieee.org/802.11/dcn/21/11-21-0733-00-0arc-arc-sc-teleconference-minutes-26-april-202118.docx)
  + April 29: [11-21/0752r0](https://mentor.ieee.org/802.11/dcn/21/11-21-0752-00-0arc-arc-sc-teleconference-minutes-29-april-2021.docx)

**Moved: Joseph Levy**

**Seconded: Graham Smith**

**Result:** The minutes were approved by unanimous consent.

## Contribution/discussion topics

**Annex G way forward:**

* Straw Polls from March inconclusive:

**March Straw Poll on Annex G (pick one answer)**

* + **8 votes for: Update Annex G – be correct and complete (in EBNF)**
  + **8 votes for: Replace Annex G with some other notation/style**
    - Still communicate the concepts, but simpler (\_maybe\_? less rigorous)
  + **9 votes for: Remove Annex G, replace references (direct or indirect) in text if/where needed.**
  + **19 votes for: Limit the scope of Annex G** 
    - To certain PHYs? Or some other historical cut-off? Certain kinds of sequences? (Done by excluding where it doesn’t apply?)
  + **8 votes for: Change to informative**
    - Perhaps also “limit” it. Probably still needs to have references replaced
  + **65 “votes for” No response**

**March Straw Poll on Annex G (pick multiple answers)**

* + **Update Annex G – be correct and complete (in EBNF) 20**
  + **Replace Annex G with some other notation/style 16**
  + Still communicate the concepts, but simpler (\_maybe\_? less rigorous)
  + **Remove Annex G, replace references (direct or indirect) in text if/where needed. 22**
  + **Limit the scope of Annex G 25**
  + To certain PHYs? Or some other historical cut-off? Certain kinds of sequences? (Done by excluding where it doesn’t apply?)
  + **Change to informative 15**
  + Perhaps also “limit” it. Probably still needs to have references replaced
  + **No response 66**

C – Support for separating the definition of frame sequences from annex G.

C – A list of the frame exchanges that shouldn’t be interrupted should be in the specification. But the instruction/introduction information of frame exchanges in Annex G does not clearly state this. Some exchanges are protected, and some are not. Suggest defining frame exchange sequences to be uninterruptible exchanges and the frame exchanges that don’t need to uninterruptible in a different list.

C – Some support for providing this information.

C – Legacy device need to be able to deal with devices – so we can’t create a such a list.

C – Transmission may continue in a TXOP – things may change, there are two things e.g., PS change and immediate frame exchanges.

C – It should be possible to deal with legacy. There is no intent to change the requirements, only clarify them.

Presenting - Remove Annex G – [11-21/0578r1](https://mentor.ieee.org/802.11/dcn/21/11-21-0578-01-0arc-obsolete-annex-g.docx) Graham Smith

C – Supportive of the proposed approach.

C – We should try to disentangle “special” frame exchange sequences and just frame exchanges.

C – The text is inconsistent with frame exchange sequences and frame exchanges. Consistency is important but doing so is a real pain. We could use annex G to clarify what we are doing in particular clauses.

C – Support for the previous statement for a two step process: 1) redefine frame exchange sequence and 2) update where it used. Also, all places Annex G is referenced should be looked at as well as where it hasn’t been referenced. We should consider what needs to be updated. The first step is to redefine frame exchange sequences. 11-21/0833r0 provides a draft definition.

Chair – the general direction is that we need a definition of “frame exchange sequence” or the term of choice. How rigorous do we need to be?

Reviewing the definition: “frame exchange sequence – the order in which particular frames are transmitted to complete an exchange.”

C - The import part is exchange and response that must happen.

C – More specificity is required.

Chair – let’s proceed in defining the concept and we’ll name it later. Also, we have “frame sequence”, in addition to “frame exchange” and “frame exchange sequence”.

C – Proposing to define these in Annex G, as the definition seems to vary in different clauses.

[11-21/0833r0](https://mentor.ieee.org/802.11/dcn/21/11-21-0833-00-0arc-frame-exchange-sequence-annenx-g-divorce.docx) – Robert Stacey (Intel) presenting.

Context of PS and media control.

Proposed definitions:

1. “**frame exchange sequence:** A frame that is not an immediate response and that does not solicit an immediate response, or a sequence of frames exchanged between two STAs where each frame in the sequence is addressed to the other STA and either solicits an immediate response from the other STA or is the response to a frame from the other STA that solicits an immediate response. If the frame exchange sequence consists of frames transmitted by more than one STA, then the frame exchange sequence is carried in SIFS separated PPDUs that might include a PPDU that does not carry any frames (e.g., an NDP PPDU).”
2. “**frame exchange sequence:** A sequence of frames exchanged between two STAs where each frame in the sequence is addressed to the other STA and either solicits an immediate response from the other STA or is the response to a frame from the other STA that solicits an immediate response. A frame exchange sequence is carried in SIFS separated PPDUs that might include a PPDU that does not carry any frames (e.g., an NDP PPDU).”

C - The current annex G does include some single frame exchanges.

A - Leaning toward not needing to include single frame “exchanges”.

C – Are you talking about an uninterruptible exchange of frames or exchanges that may be interrupted.

A – Both – it is possible to poll a STA and acknowledge another STA.

C – So it is possible to have interleaved transmissions. To a passive observer STA – does the STA see an uninterruptable sequence.

C - The observer STA would see a sequence of PPDUs with SIFs separated – which it can’t interrupt, but it would not see a frame exchange sequence. This is done for good reason as only the intended STAs can see the frame exchange sequence.

C – Defining a frame exchange sequence – with a single frame is not a good idea.

A – Agree – this doesn’t then need to cover the single frame. The current Annex G – does contain single frames. We should limit a sequence to include 2 frames.

C – So we are talking about SIFS separated exchanges? Is RIFS still there?

C – RIFS have been deprecated.

C – What about PIFs recovery and waiting 192 us – why restrict this to SIFS.

C – OFDMA allow for multiple frames – which are simultaneous.

C – Unicast exchanges don’t matter if they are sent on orthogonal resources, it is the sequence that matters?

C – Parallel sequence are possible – but each would be a separate frame exchange sequence.

C – We should say immediate responses, and not use SIFS.

C – Does a probe request solicit a probe response?

C – The use of solicits in interesting.

C – Concern was expressed about mixing PHY concepts into this MAC definition.

The author edited the text to say immediate response. –

C – The term immediate response is used in the spec – we should check how it is used.

C – A request was made to review the PS example.

C – MLME-START.request – uses frame exchange sequence –

Chair – Let’s work on the concept and figure out what to call it.

C – Strongly suggesting against making big changes.

Discussion – on Why is any timing needed for MLME-START. Why is a request contingent on anything other than media access? Starting the process does not mean the frame is immediately sent.

Discussion on - QoS facility definition – agreement that this seems to be ok.

C – If the transmission is successful – do I need to get an ACK? A sequence of ACKed frames is a sequence. Regarding time – 802.11 only addresses time via State diagram – perhaps we should incorporate this as a state machine – this could provide a way to go.

C – Discussed the example Data – ACK “exchange” vs. a fragmented Data frames and ACKs “exchange”.

C – A GCR block ACK is called a frame exchange sequence – but this is really just an exchange of frames.

C – In most cases it is management that uses frame exchanges. But there are uses of frame exchange sequence that are frame exchanges.

C – A request was made for adding that this is term used in a special way with an example.

A – This was not supported

C – When do these frames exchange sequence terminate. GCR – you send a series of frame and ask for a BLOCK Ack from each intended STA – when does the frame exchange end – when the STA sends its block ack or when all the block acks are completed by all the STAs?

A – The original block ack was not a SIFs separated exchange. You deliver the ACK when you can.

Is it necessary that everything is part of the frame exchange sequence be separated by SIFS?

C – The text currently says that GCR is all one frame exchange sequences. Which is extensive – so this will be difficult to change.

R - They are distinct.

R – The first group member – sends the block ACK –

The Chair called time.

Going to next steps – we will continue this topic.

## Next Steps:

Do we need more time slots in July?

The Chair will consider 3 slots.

Looking for teleconferences – Monday 1 PM ET – Annex G and Thursday 7 PM TGbe topics - Will look at ½ slot for each topic each meeting.

## Adjourned: 13:16 h EDT

Note, the final agenda is [11-21/0611r5](https://mentor.ieee.org/802.11/dcn/21/11-21-0611-05-0arc-arc-sc-agenda-may-2021.pptx) , the closing report is [11-21/0856r2](https://mentor.ieee.org/802.11/dcn/21/11-21-0856-02-0arc-arc-closing-report-may-2021.pptx) .