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Sent: Monday, June 21, 2021 5:20 AM
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Subject: Response on the liaison response on the use of faster CCM transmission intervals in IEC 62439-2
Attachments: liaison-iec65cwg15-CCM_interval_extension_suppl-0621-v1.pdf

Flag Status: Flagged

Dear Colleagues,

in your liaison response on the use of faster CCM transmission intervals in IEC 62439-2 from March 16, 2021, you requested further information on this topic.

The enclosed slide set tries to answer these questions.

Would it be possible to reserve a time slot for the presentation and discussion of it during the next IEEE 802.1 working group meeting?

Best Regards/Mit freundlichen Grüßen
Thomas Weichlein

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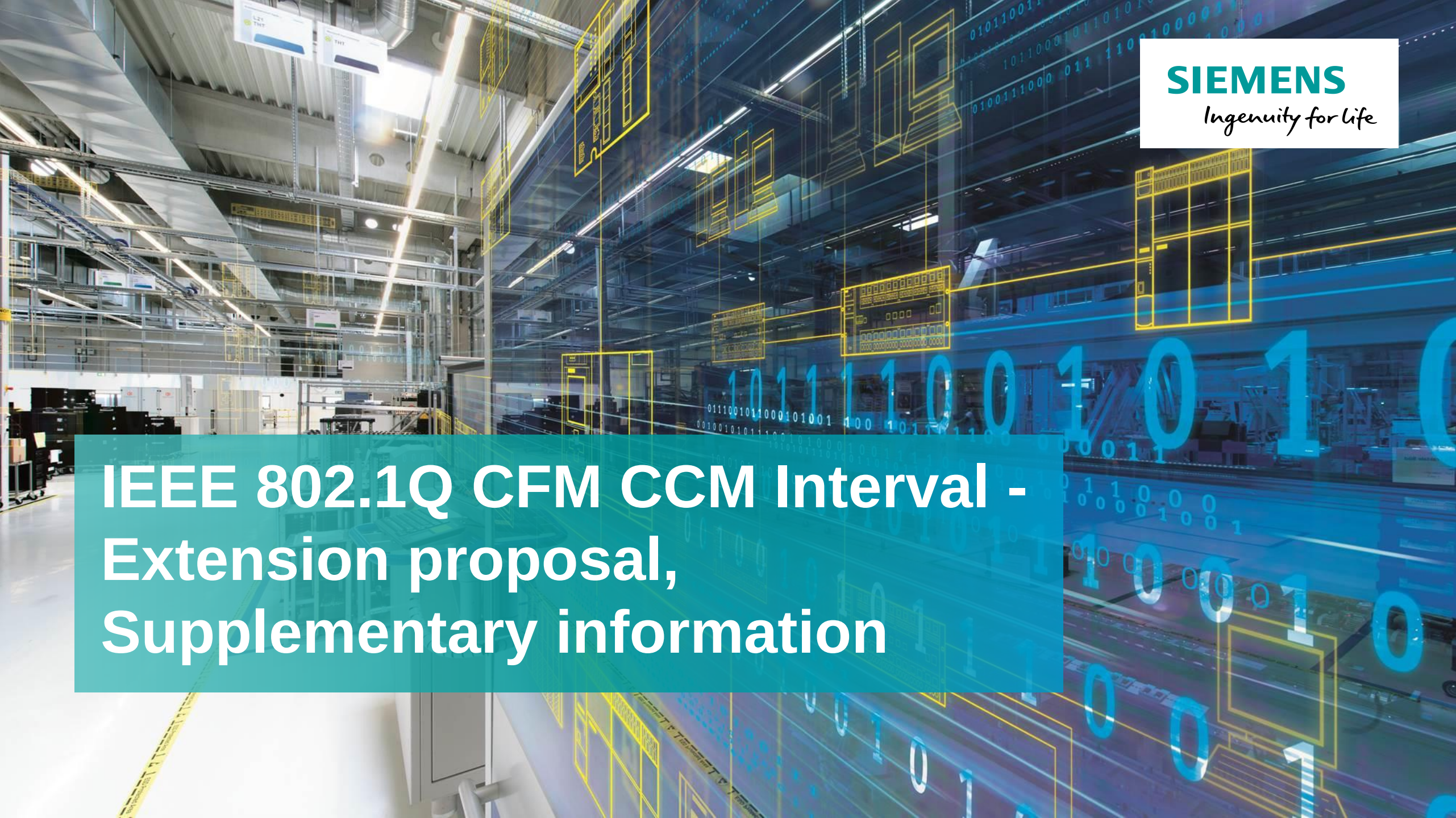

IEEE 802.1Q CFM CCM Interval - Extension proposal, Supplementary information

Change Proposal for IEEE 802.1Q CFM CCM Intervals - Introduction

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- **With the presentation of the IEEE 802.1Q CFM CCM Intervals – Extension proposal: https://www.ieee802.org/1/files/public/docs2021/liaison-iec65cwg15-CCM_interval_extension-0321-v2.pdf an extension of the current CFM CCM Intervals had been proposed.**

- **After discussion of the proposal in the IEEE 802.1Q Working Group, further information on the application plans for this extension was requested:**

  (We would like to better understand why faster CCM transmission, as opposed to instantaneous reconfiguration via FRER, matters in your use case. To help us better understand your need for faster CCM transmission intervals, we would welcome an overview of how MRP with faster reconfiguration would be used as well as clarification of the link speeds targeted, of the number of services carried on a given link, whether MRP link checks apply to a single IEEE Std 802.3link or to the serial concatenation of such links, whether link technologies other than as specified in IEEE Std 802.3are supported, whether CCM-based link failure detection is in addition to link-level hardware detection and if so, how the two interact.)

- **The requested information is provided by this presentation**

Change Proposal for IEEE 802.1Q CFM CCM Intervals - MRP positioning

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Question: … why faster CCM transmission, as opposed to instantaneous reconfiguration via FRER, matters in your use case.)

- **IEEE 802.1CB FRER and IEC 62439-3 PRP and HSR would offer zero reconfiguration time seamless media redundancy as an alternative to switch-over redundancy of MRP.**
- **But these seamless protocols place higher demands on the devices due to the need for duplicate sending and filtering of frames. Alternatively, for devices not capable of this, the application of additional seamless network access devices (RedBoxes) would be necessary.**
- **In addition, FRER is only for streams, but redundancy is needed for all traffic.**
- **The MRP advantage is, that it allows very cost sensitive ring devices, a requirement which is essential in certain automation areas.**
- **Furthermore, particularly in networks with high communication traffic, seamless transport might not be possible for all traffic because of limited device resources. In this case it requires the application of an additional non-seamless protocol (MRP or RSTP/MSTP) for less important traffic in parallel.**

Change Proposal for IEEE 802.1Q CFM CCM Intervals - CFM CCM use with MRP

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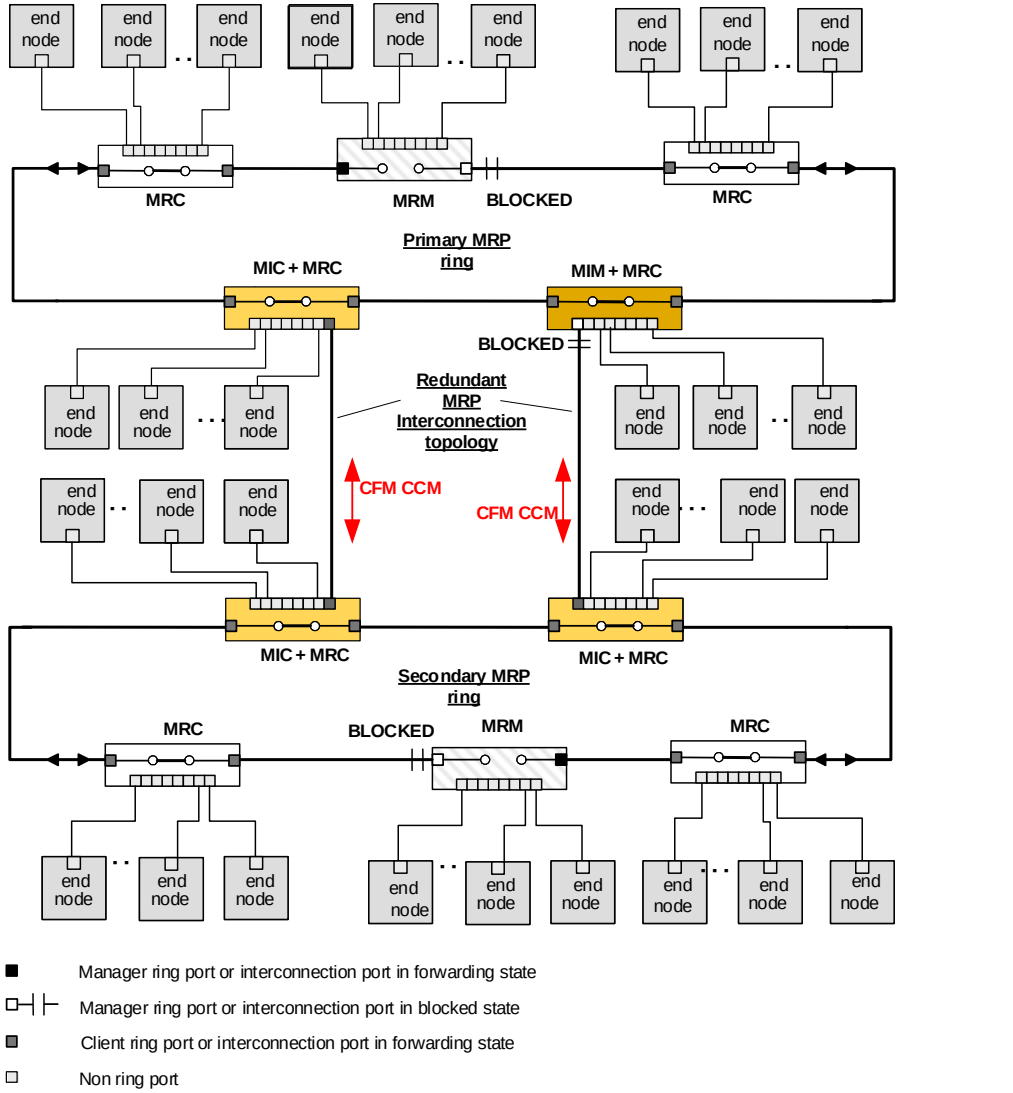
Question: …how MRP with faster reconfiguration would be used as well as clarification of the link speeds targeted

- The IEC 62439-2 standard uses the CCM for link detection in conjunction with the Media Redundancy Protocol (MRP).
- The link detection via CCM is particularly important for the MRP-Interconnection link supervision.
- CCM for MRP are applied on single links, i.e. on CFM level 0 (no serial concatenation of links)
- MRP was mainly aiming at 100 MBit/s and 1 GBit/s, but allows also 10 MBit/s and higher bitrates than 1 GBit/s (for bandwidth consumption considerations see backup slides)



Change Proposal for IEEE 802.1Q CFM CCM Intervals - Information on link handling with MRP

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Question: … of the number of services carried on a given link, whether MRP link checks apply to a single IEEE Std 802.3 link or to the serial concatenation of such links, whether link technologies other than as specified in IEEE Std 802.3are supported, whether CCM-based link failure detection is in addition to link-level hardware detection and if so, how the two interact.)

- **As to the question of number of services carried on a link, it can be stated that MRP does not specify this for the payload of the links, i.e. there is no limitations compared to any other IEEE 802.1Q supporting link.**
- **As to the question of link technologies other than IEEE 802.3Q, it can be stated that MRP does not restrict this.**
- **Basically, the CCM link detection can either replace or enhance the hardware link detection of the PHY. Experience shows that hardware link detection at the PHY can be ambiguous in certain cases with certain PHYs, e.g. if only one direction of a cable has an interruption. The precise strategy of a cooperation of CCM and PHY detection is not defined with MRP and is left up to the designer (e.g. detection of Link-up if both PHY and CCM say so, detection of Link-down if either PHY or CCM is saying so).**

Change Proposal for IEEE 802.1Q CFM CCM Intervals - CCM influence on MRP reconfiguration timing

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- Today, to achieve a 200 ms MRP Interconnection reconfiguration time, CCM with the fastest intervals of 10 ms and 3.33 ms can be used.
- But to fulfill enhanced timing requirements of faster reconfiguration profiles of 30 ms and 10 ms for MRP Interconnection, even faster CCM intervals would be required (for a calculation example see backup slides).
- Therefore we would like to propose the introduction of further, faster CCM interval codings.

Change Proposal for IEEE 802.1Q CFM CCM Intervals - Backward compatibility considerations

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- The additional bits to be used in the flags octect currently have the status “reserved”.
- IEEE 802.1Q-2018 says:
  - **21.6.1.2 Reserved**

    The bits of the Flags field not including the RDI field, the Traffic field, and the CCM Interval field are set to 0 by the transmitting MP, and <u>are not to be examined</u> by the receiving MP [item b) in 20.51.2].
  - **20.51.2 PDU transmission**

    In order to ensure that future versions of CFM will be compatible with implementations of this standard,
    certain requirements are placed on transmitted CFM PDUs:
    …b) All bits defined as “reserved” in this standard, e.g., unused bits in the Flags field, shall be transmitted as 0.

-> Conclusion: older implementations parsing the flags octet should not examine these bits as they were reserved before the change. Moreover: if reserved bits can never be used later on, what is then the purpose of reserving?

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Backup material

Change Proposal for IEEE 802.1Q CFM CCM Intervals
- Example calculation for 30 ms MRP Interconnection reconfiguration

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Rough calculation:

- Link loss detection (3 times 1 ms CCM cycle): 3 ms
- Link loss information from MIC[1] to MIM[2]
  (3 frames with 1 ms plus max ring delay 6,9 ms): 9.9 ms
- Topology change distribution from MIM to MRM[3]
  (3 frames with 1 ms plus max ring delay 6,9 ms): 9.9 ms
- Topology change distribution from MRMs to MRCs[4] 6.9 ms
- FDB flush time 1 ms
- ----------
- **Sum reconfiguration time: 30.7 ms**

- -> this would not be possible with a CFM CCM cycle for link loss detection of 3.33 ms resulting in a link loss detection time of 10 ms instead of 3 ms

[1] MIC: MRP Interconnection Client
[2] MIM: MRP Interconnection Client
[3] MRM: Media Redundancy Manager
[4] MRM: Media Redundancy Client

Change Proposal for IEEE 802.1Q CFM CCM Intervals - CFM CCM bandwidth consumption considerations

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Basically, the length of CFM CCM frame is variable due to partly optional content. The minimum length is 75 octets.

Bandwidth consumption:

Bitrate	Interval ms	Available Bits/interval	Bits for 75 Octets	Bandwidth consumption Percent	Bits for 200 Octets	Bandwidth consumption Percent	Comment
10 MBit/s	0.1	$(10 \times 10^6 / 10000) = 1000$	600	60	1600	160	critical
	1	$(10 \times 10^6 / 1000) = 10000$	600	6	1600	16	
	2	$(10 \times 10^6 / 500) = 20000$	600	3	1600	8	
100 MBit/s	0.1	$(100 \times 10^6 / 10000) = 10000$	600	6	1600	16	
	1	$(100 \times 10^6 / 1000) = 100000$	600	0.6	1600	1.6	
	2	$(100 \times 10^6 / 500) = 2000000$	600	0.3	1600	0.8	
1 GBit/s	0.1	$(1000 \times 10^6 / 10000) = 100000$	600	0.6	1600	1.6	
	1	$(1000 \times 10^6 / 1000) = 1000000$	600	0.06	1600	0.2	
	2	$(1000 \times 10^6 / 500) = 20000000$	600	0.03	1600	0.1	

Thank you for your attention!

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