IEEE P802.11
Wireless LANs

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| Considerations for Liaison Statement to SC6 on Wi-Fi in wireless industrial networks |
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Abstract

This document contains a response to the liaison request received from ISO/IEC JTC1/SC6 re: the Preliminary Work Item (PWI) on the Deterministic Wireless Industrial Network project.

Rev 1: Edited by Andrew Myles to address potential confusion from the use of Wi-Fi 6 and Wi-Fi 7 terminology. The use of these terms has been avoided, except in the reference to the Wireless Broadband Alliance (WBA) IOT working group activity. Wi-Fi and Ethernet are used generically.

Rev 2: Updated list of references and removed reference to 22-11-0080.

Rev 3: Editorial changes after review with the 802.1 TSN group.

Rev 4: Incorporates edits proposed by Dorothy Stanley, and minor editorial tweaks by Andrew Myles

# IEEE 802 is providing comments on the PWI proposal for a *Deterministic Wireless Industrial Network* project

At the ISO/IEC JTC1/SC6/WG1 meeting in August/September 2021, the N17531 [6] submission proposes a *Deterministic Wireless Industrial Network* project. Subsequently, a request from WG1 (see WG1 N299) was made for comments from National Bodies and other SDOs to be submitted to ISO/IEC JTC1/SC6/WG1 for consideration at its interim meeting in February 2022. This Liaison Statement contains the IEEE 802 response to that request.

# Industrial networks are evolving to use TSN over standards based, widely available networks

Industrial networks are evolving from being based on proprietary protocols to using standards-based networks, leveraging widely available connectivity protocols. In particular, they are often converging on IEEE 802 LAN and Time-Sensitive Networking (TSN) standards to deliver time synchronization and bounded latency with determinism. The industry ecosystem for TSN is rapidly developing based on use of various IEEE 802.1, IEEE 802.3 (Ethernet), IEEE 802.11 (Wi-Fi) and 3GPP (5G) standards. An overview of wireline and wireless TSN extensions can be found in [1].

The use of TSN over widely available connectivity protocols and networks is also being supported by a variety of other organisations. For example, the IEC/IEEE 60802 Joint Project is defining a TSN Profile for Industrial Automation [2]. Certification for TSN capable networks is also being developed in IEC 61802 and as part of the Avnu Alliance, including wired and wireless networks [3]. Trials using Wi-Fi 6 and TSN for Industrial IOT application are underway in the Wireless Broadband Alliance (WBA) IOT working group [4].

Industrial networks serve a wide range of applications with heterogenous requirements. Time synchronized isochronous traffic is one of the key applications. The benefits of wireless networks are obvious in many applications requiring mobility and flexibility. As can be seen by the activities across several industry forums, there are considerable efforts currently underway to address the requirements of time-sensitive applications in converged and standard-based wired and wireless networks. A wide range of wireless use cases and their requirements are available, as defined by several industry forums [3][4][5].

# The 802.3 and 802.11 standards continue to be refined to meet industrial network requirements for TSN

The IEEE 802.11 WG and the IEEE 802.3 WG have been collaborating for many years with the IEEE 802.1 TSN Task Group. Several TSN features are applicable for both 802.3 and 802.11 based network use. For example, time distribution and synchronization based on IEEE 802.1AS has been standardized over both 802.3 and 802.11 media, with support for 802.11 enabled by Timing Measurement (TM) and Fine Timing Measurement (FTM). Recent enhancements in the IEEE Std 802.11ax™-2021 standard enable multi-user scheduling, combined with TSN traffic scheduling (as defined by IEEE 802.1Qbv), which can enhance determinism and support low bounded latency with high confidence.

Given the convergence toward TSN, as acknowledged in the ISO/IEC JTC 1/SC 6 proposal [6], and industry efforts on extending TSN over 802.3 and 802.11 networks, there is a clear path to address the practical needs of todays and future industrial networks that will enable integration of IT (Information Technology) and OT (Operational Technology). Although 802.3 and 802.11 technologies can already address various use cases, it is expected that these connectivity technologies, especially 802.11 capabilities will continue to evolve to support more use cases that need lower latencies, higher reliability with higher efficiency. Industry efforts continue to enable new capabilities in next generation IEEE 802.11 standards. For instance, the IEEE P802.11be project is introducing enhancements to better support TSN scheduling. It is also expected that ultra-low latency and determinism will continue to be key requirements for future IEEE 802.11 generations beyond IEEE P802.11be.

# IEEE 802 requests that ISO/IEC JTC1/SC6/WG1 assist in developing 802.3 and 802.11 refinements

IEEE 802 believe the ongoing refinement of the IEEE 802.11 and IEEE 802.3 standards to support the needs of industrial networks, in parallel to the TSN work in IEEE 802.1 WG, will best enable the transformation of industrial networks towards IT/OT convergence. This approach will meet the needs of industrial networks into the future and is more likely to succeed in the marketplace because it does not require the deployment of a completely new network. Given the wide range of applications and requirements, there are many opportunities for collaboration across standard organizations and forums to understand the challenges and gaps in existing Wi-Fi and Ethernet connectivity capabilities to address the needs of future industrial networks.

IEEE 802 requests that ISO/IEC JTC1/SC6/WG1 focus its industrial networking efforts on assisting IEEE 802 to refine its solutions, rather than focusing efforts on yet another wireless network solution. IEEE 802 invites ISO/IEC JTC1/SC6/WG1 to provide a Liaison Statement to IEEE 802 that highlights its perspective on how the IEEE 802.3 and IEEE 802.11 standards can be improved to better meet industrial networking needs. We hope that this would then become the basis of ongoing collaboration.

# References

1. D. Cavalcanti et al, “Extending Accurate Time Distribution and Timeliness Capabilities over the Air to Enable Future Wireless Industrial Automation Systems,” accepted for publication in the Proceedings of the IEEE, March 2019: <https://www.researchgate.net/publication/331942593_Extending_Accurate_Time_Distribution_and_Timeliness_Capabilities_Over_the_Air_to_Enable_Future_Wireless_Industrial_Automation_Systems>
2. https://1.ieee802.org/tsn/iec-ieee-60802/
3. Avnu Alliance Wireless TSN working group: <https://avnu.org/wirelessTSN/>
4. Wireless Broadband Alliance: <https://wballiance.com/resources/wba-white-papers/>
5. IEEE 802.11 Real-Time Applications (RTA) Topic Interest Group Report Summary and Recommendations, <https://mentor.ieee.org/802.11/dcn/19/11-19-0065-06-0rta-rta-tig-summary-and-recommendations.pptx>
6. ISO/IEC JTC 1/SC 6 N 17531 “PWI Proposal on Deterministic Wireless Industrial Network”.