IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Considerations for Liaison Statement to SC6 on Wi-Fi in wireless industrial networks | | | | |
| Date: 2021-09-19 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
| Dave Cavalcanti | Intel Corporation |  |  | [dave.cavalcanti@intel.com](mailto:dave.cavalcanti@intel.com) |
| Ganesh Venkatesan |  |  | ganesh.venkatesan@intel.com |
| Malcolm Smith | Cisco |  |  | [mmsmith@cisco.com](mailto:mmsmith@cisco.com) |
| Maik Seewald |  |  | maseewal@cisco.com |

Abstract

This document proposes a response for consideration to be included in the liaison response from the IEEE 802 to the liaison request received from ISO/IEC JTC1/SC6.

Rev 1: Edited by Andrew Myles to reflect a concern expressed about 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 ae used generically

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

# IEEE 802 would like to comment on the PWI proposal for a *Deterministic Wireless Industrial Network* project

At the last ISO/IEC JTC1/SC6/WG1 meeting in August/September 2021, a submission from the Korea NB made a PWI proposal for a *Deterministic Wireless Industrial Network* project. Subsequently, after some discussion, a request was made for comments to be submitted for consideration by ISO/IEC JTC1/SC6/WG1 at its interim meeting in February 2022. This Liaison Statement is IEEE 802’s response to that request.

# Industrial networks are evolving to use TSN over widely available connectivity

Industrial networks are evolving from proprietary protocols to standard-based networks, leveraging widely available connectivity. 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 developing leveraging various IEEE 802.1, IEEE 802.3 (Ethernet), IEEE 802.11 (Wi-Fi) and 3GPP (5G) standards. An overview of wired and wireless TSN extensions can be found in [1].

The use of TSN over widely available connectivity is also being supported by a variety of other organisations. For example, an Industrial TSN profile is being defined as part of the IEC/IEEE 60802 project [2]. Certification for TSN capable networks is also being developed as part of the Avnu Alliance, including wired and wireless networks [3]. Trials including 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 are obvious in many applications requiring mobility and flexibility. As can be seen by the activities across several industry forums there are considerable efforts 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, as defined by several industry forums [3][4][5]..

# Wi-Fi and Ethernet 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 TG. Several TSN features have been defined for both Ethernet and Wi-Fi. For example, time distribution and synchronization based on IEEE 802.1AS has been standardized over both Ethernet and Wi-Fi media, with support for Wi-Fi enabled by Timing Measurement (TM) and Fine Timing Measurement (FTM). Recent enhancements in the IEEE 802.11ax standard enabling multi-user scheduling, combined with TSN traffic scheduling (as defined by IEEE 802.1Qbv) can enhance determinism and support low bounded latency with high reliability.

Given the convergence toward TSN, as acknowledged in the ISO/IEC JTC 1/SC 6 proposal [6], and industry efforts on extending the TSN over Ethernet and Wi-Fi, 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 Ethernet and Wi-Fi can already address various use cases, it is expected that these connectivity technologies, especially Wi-Fi 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, IEEE802.11 TGbe is already 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 802.11be.

# IEEE 802 requests that ISO/IEC JTC1/SC6/WG1 assist the Wi-Fi and Ethernet refinement process

IEEE 802 believe the ongoing refinement of Wi-Fi in the IEEE 802.11 WG and Ethernet in the IEEE 802.3 WG 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 and guide the development of next generation Wi-Fi and Ethernet to address the needs of future industrial networks.

IEEE 802 would like to request that ISO/IEC JTC1/SC6/WG1 focus its industrial networking efforts on assisting IEEE 802 to refine Wi-Fi and Ethernet based 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 IEEE 802.11 and IEEE 802.3 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, February 2019.
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”.