Overview on UWB standard 802.15.4-2024

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***Abstract*—The purpose of this survey is to understand and address these topics of the standard IEEE 802.15.4-2024, "IEEE Standard for Low-Rate wireless networks": Architecture, where we will s**

I. Introduction

The standard covers many physical layers and one Medium Access Control layer (MAC) for low rate wireless personal area networks (LR-WPAN). There are some special applications such as Smart Utility Network, Rail Communications and Control, Radio Frequency Identification (RFID), Medical Body Area Networks. Among many others it covers the one we are interested in, the Ultra Wide Band (UWB) technology. UWB is a technology generally defined like others in the standard as a Wireless Personal Area Network (WPAN). So we will give an quick overview of the standard and then focus on the UWB technology.

II. General Description

A. Network Topologies

Topologies for LR-WPAN are two, star and peer-to-peer. In the star topology, the coordinator is the central device and the other devices are the end devices. The coordinator is the only device that can communicate with the end devices, and is usually wall powered, whilst end devices are battery powered. Suited for home automation, personal health care and games. The peer-to-peer topology is a network of devices that can communicate with each other, thus allowing for more complex networks, such as mesh networks, using multiple hops, implemented at higher level, thus not discussed in this standard. Suited for sensor networks, enabling smart agriculture, industrial control and monitoring and asset and inventory traking.

Each indipendent PAN selects a UID (PAN Identifier) thus allowing for multiple PANs to coexist, moreover each device in a PAN can communicate within with a short address, permits to communicate also with another device from another PAN.

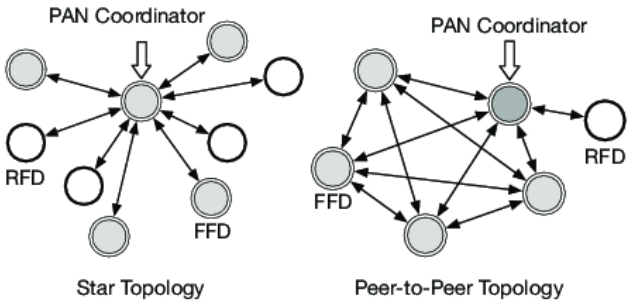

Fig. 1. Star and peer-to-peer topologies

B. Architecture

The architecture is composed of three layers:

- Physical Layer (PHY)
- Medium Access Control (MAC)
- Higher layers

Only PHY and MAC are defined in the standard, the higher layers, such as network, that involves its configuration, message routing and manipulation are left to the implementer. as well as the application layer.

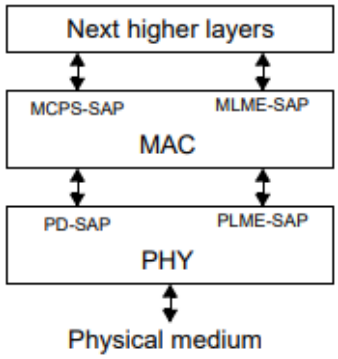

Fig. 2. IEEE 802.15.4-2024 architecture

1) Physical Layer (PHY): The PHY layer has its main focus on the activation and deactivation of the radio transceiver, energy detection, link quality indication, channel selection,

clear channel assessment, ranging and data transmission and reception. In the specific case of High Rate Pulse repetition frequency UWB, it also serves the purpose of precision ranging.

2) Medium Access Control (MAC): The MAC overlay provides 2 services:

- Data service
- Management service

The data service is responsible for the MAC protocol data units transmission and reception, whilst the management service is responsible for the interfacing with the MAC sublayer management entity service access point (MLME-SAP fig.2). In particular the MAC overlay provides the possibility to manage beacons, channel access, association and disassociation, acknowledged frame delivery, guaranteed time slots management and frame validation. In addition can provide security features (TODO: UWB?).

C. Functional overview

1) Scheduled access: Access is managed by different implementations of the superframe structure.
Beacon superframe, defined and sent by the coiordinator, dependant on beacons. Can have an active and inactive portion, during the latter the coordinator is able to enter low-power mode (sleep), thus saving energy. Beacon transmission is executed at the beginning of each superframe by the coordinator, in order to synchronize and identify the devices of the PAN. It can be avoided by the coordinator bypassing the beacon transmission.

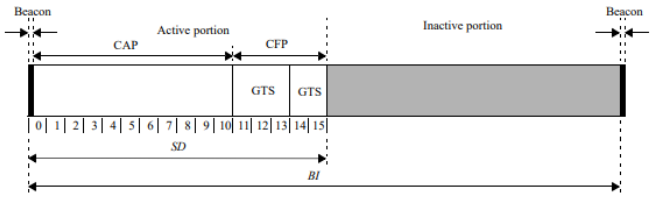

Fig. 3. Beacon superframe

Deterministic and synchronous multichannel extension (DSME) superframe,

III. Conclusion

The conclusion goes here.

Acknowledgment

The authors would like to thank...

References

[1] H. Kopka and P. W. Daly, *A Guide to LaTeX*, 3rd ed. Harlow, England: Addison-Wesley, 1999.