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Zigbee Technology

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ABSTRACT

Zig Bee is one of the networking technologies that is emerging in today's world. It is widely used in smart homes and IoT based devices. Zigbee is a standards-based wireless technology developed to enable low-cost, low-power wireless machine-to-machine (M2M) and internet of things (IoT) networks. Zigbee is for low-data rate, low-power applications and is an open standard.

Introduction:

Zig bee is an IEEE 802.15.4-based specification for a suite of high-level communication protocols used to create personal area networks with small, low-power digital radios, such as for home automation, medical device data collection, and other low-power low-bandwidth needs, designed for small scale projects which need wireless connection. The technology defined by the Zigbee specification is intended to be simpler and less expensive than other wireless personal area networks (WPANs), such as Bluetooth or more general wireless networking such as Wi-Fi. Applications include wireless light switches, home energy monitors, traffic management systems, and other consumer and industrial equipment that requires short-range low-rate wireless data transfer.[1] ZigBee Technology supports transfer of simple data like that from sensors. It supports low data rate of about 250 kbps. The operating frequencies are 868 MHz, 902 to 928 MHz and 2.4 GHz. ZigBee Technology is used mainly for applications requiring low power, low cost, low data rate and long battery life.

Types of ZigBee Devices:

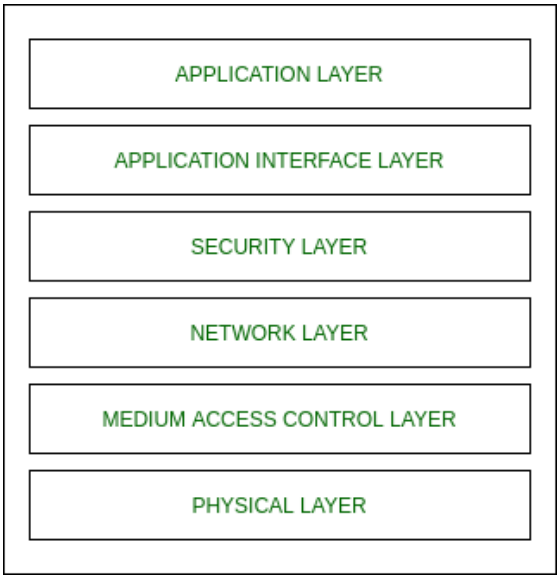
Zigbee Coordinator Device: It communicates with routers. This device is used for connecting the devices.

Zigbee Router: It is used for passing the data between devices.

Zigbee End Device: It is the device that is going to be controlled.

Architecture of Zigbee: Zigbee architecture is a combination of 6 layers.

1. Application Layer
2. Application Interface Layer
3. Security Layer
4. Network Layer
5. Medium Access Control Layer
6. Physical Layer

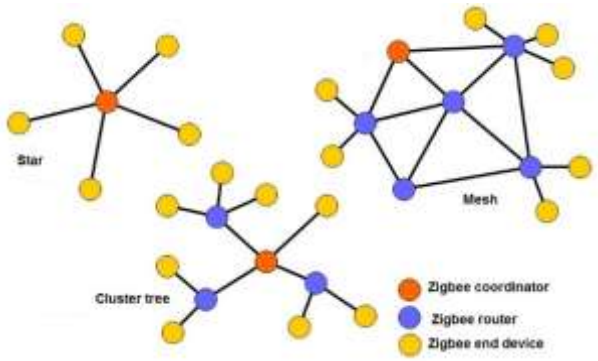


- **Physical layer:** The lowest two layers i.e the physical and the MAC (Medium Access Control) Layer are defined by the IEEE 802.15.4 specifications. It is closest to the hardware and directly controls and communicates with the Zigbee radio. It translates the data packets in the over-the-air bits for transmission and vice-versa during the reception.
- **Medium Access Control layer (MAC layer):** The layer is responsible for the interface between the physical and network layer. It is also responsible for providing PAN ID and also network discovery through beacon requests.
- **Network layer:** This layer acts as an interface between the MAC layer and the application layer. It is responsible for mesh networking.
- **Application layer:** The application layer in the Zigbee stack is the highest protocol layer and it consists of the application support sub-layer and Zigbee device object. It contains manufacturer-defined applications. [3]

Network Topologies of ZigBee:

ZigBee Network supports many types of topologies, the popular one being – star and peer to peer topologies. Each network topology consists of three types of nodes – ZigBee Coordinator, ZigBee Router and ZigBee End Device

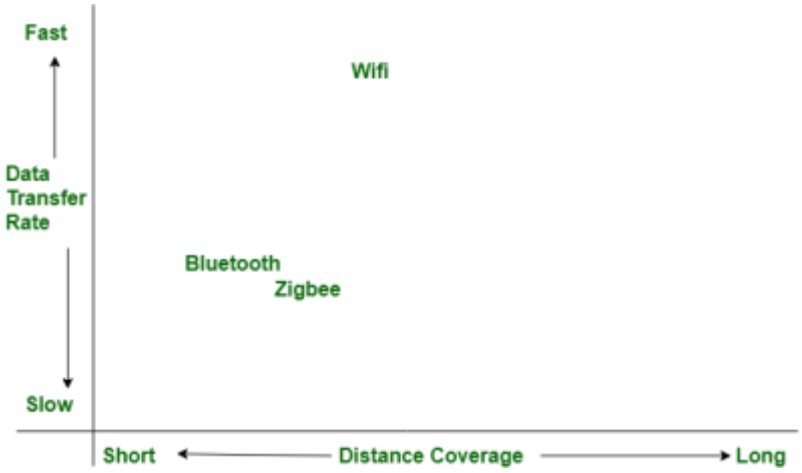
In a Star Topology, the Coordinator is the central device which initiates and manages devices within the network. Each coordinator selects a unique identifier, which is not used by any other network within its region of influence. A Peer to Peer Topology can be a Mesh topology or a Tree Topology.[2] Cluster tree network has strong expansion ability, and has the advantages of star network and mesh network



Difference between Bluetooth and Zigbee:

Bluetooth was developed under IEEE 802.15.1, which is used for providing wireless communication through radio signals. The frequency range supported in Bluetooth varies from 2.4 GHz to 2.483 GHz. It covers less distance than Zigbee. In Bluetooth, GFSK modulation technique is used.

Whereas in **Zigbee**, BPSK and QPSK modulation techniques are used like UWB (Ultra-Wide Band). the frequency range supported in Zigbee is mostly 2.4 GHz worldwide, which means 2.4 GHz is not supported at all times. It covers more distance as compared with Bluetooth. [3]



Features of Zigbee :

- Support for multiple network topologies such as point-to-point, point-to-multipoint and mesh networks
- Low duty cycle – provides long battery life
- Low latency
- Direct Sequence Spread Spectrum (DSSS)
- Up to 65,000 nodes per network
- 128-bit AES encryption for secure data connections

- Collision avoidance, retries and acknowledgements[4]

Advantages of Zigbee:

- Support for multiple network topologies such as point-to-point, ...
- Low duty cycle – provides long battery life.
- Low latency.
- Direct Sequence Spread Spectrum (DSSS)
- Up to 65,000 nodes per network.
- 128-bit AES encryption for secure data connections.
- Collision avoidance, retries and acknowledgements.

Conclusion

ZigBee has been developed to meet the growing demand for capable wireless networking between numerous low-power devices. These networks are easy to deploy which is cheaper as compared to other technologies. Used for campus-wide electrical and security systems from a single computer.[6]

References:

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