# ZigBee- Sketch

- Mostly used as a smart home protocol
- Not like wifi, but ZigBee is designed for low-power wireless applications. Like consumer electronics, medical equipment, industrial automation and home automation.
- 2.4GHz radio frequency space,
- Wireless mesh network. It has two main devices.
    1. ZigBee Co-ordinator (Hub) - starting and maintaining the network connectivity. It receives the signal from ZigBee end devices, processes it and converts it to a format that computers and mobile phones can use. It is the bridge between the end device and the user's mobile phone/ computer.
    2. ZigBee end device - devices and sensors which are usually powered by a battery. It communicates back to the coordinator.
    3. ZigBee Router- Improve its mesh capabilities. Main powered devices. It can route data packets from the end devices to the coordinator. This will wider the range of the ZigBee network. Improve the strength and reliability of the network.
- Security-  AES 120 bits Encryption

Pros of ZigBee

- ZigBee's main upside (WiFi's main downside) is battery life, ZigBee is specifically designed for low-power applications. Zigbee allows the end devices to turn off the transmitting radio when the device is not transmitting. Not possible in WIFI. some Zigbee devices can last well over a year on a single battery.
- Wide Range of available devices:  Zigbee is an open standard. Therefore anybody can use it. Low cost compared with some other standers.  Because of that, there are thousands of Zigbee devices out there.
  Eg: Door/window sensors, motion sensors, water leak sensors, smart plugs, smoke alarms etc…

- Mesch capabilities- if you add more devices, the mesh will be bigger and improve the ZigBee network. For WiFi, it is also possible. But more costly and time-consuming.

Cons of ZigBee

- Co-Ordinater failure- To the ZigBee network can be added many routers, and many end devices =. But, all of them are controlled by one co-ordinator device. If it fails, the whole network fails. You have to replace the coordinator and manually reconnect all the devices back into the network.
- Ecosystems of the manufacturers - Some manufacturers took ZigBee's open standards and make it worked only in their eco-systems. They most probably do not work with other brand devices.

- Not suitable for CCTV or a doorbell with camera applications

Reference: https://m.youtube.com/watch?v=UmpDXc3cXbU

Other references for future use: Zigbee | Complete IOT Solution - CSA-IOT
https://en.wikipedia.org/wiki/Zigbee

Books: ZigBee Wireless Networks and Transceivers - Shahin Farahani - Google Books

My Books:

- (Real-Time Systems Series) Hermann Kopetz (auth.) - Real-Time Systems_ Design Principles for Distributed Embedded Applications-Springer US (2011)
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  13.3.3 Near Field Communication

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# Comparison to Bluetooth and IEEE 802.11b and WiFi

## Similarities and differences

This section is a comparison between ZigBee with WiFi and Bluetooth technologies. ZigBee has the lowest data rate compared with Bluetooth and WiFi. ZigBee has considerably longer battery life than the other mentioned technologies.

Each protocol has its advantages and disadvantages. We should know them before designing a new IOT network.
IEEE802.11 is a standard to determine the Wireless local area network (WLAN) oftentimes called WiFi. IEEE802.11b is a modification of IEEE802.11 that extends up to 11 Mbits/s using 2.4 GHz bandwidth. [1] use-cases of this standard will be smart home applications, security and office use.

1) ZigBee vs. Bluetooth
   Mesh capability: Zigbee configures it automatically. If the node is disabled or removed it has the ability to reconfigure it.
   No need to charge daily.
   Zigbee is opensource. Therefore different manufacturers can communicate seamlessly.
   Bluetooth classic is always short ranged technology and has higher bandwidth than Zigbee, is relatively power-hungry, and is designed for devices which can be recharged easily and regularly.
   However there is Bluetooth Low Energy(BLE) technology, it is also low energy, low-bandwidth, long-lasting battery. applications are similar to ZigBee
   [3]

Both IOT protocols are vastly used for local communications

2) ZigBee vs. IEEE 802.11

IEEE 802.11 is the technical standard of the brand called WiFi.

DISADVANTAGES AND CHALLENGES TO ZIGBEEE

1) Security, privacy and compatibility
   Zigbee has plenty of security issues. If there is a lack of services or a theft to a certain node, it will affect whole entire node. If a hacker got access to the node he can manipulate a node in an illegal way. [4]
2) Expensive
   Implementation of the ZigBee network might be costly. There are several use cases for this. The availability of compatible items and the equipment also influence the price. The level of compatibility also influences the cost of a specific application. [4]

3) Channel noise: Because the most common protocols and devices like Bluetooth, cordless phones, microwaves and other wireless devices share the common band of 2.4 GHz, there may be channel noise appear. [4]

4) Low transmission rate

Because ZigBee is designed for low-rate data transmission, the technology used in it has a low bit rate. As a result, it has a lower transmission rate than WiFi and Bluetooth. Therefore Zigbee is unsuitable for high-speed data transmission.[4]

5) Incompatibility:
   ZigBee has some incompatibility with common devices like smartphones and computers. [4]


Reference:

[1] IEEE 802.11b-1999 - Wikipedia

[2] ZigBee Wireless Networks and Transceivers - Shahin Farahani - Google Books
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[3] Zigbee vs. Bluetooth: Choosing the Right Protocol for Your IoT Application | Digi International

[4] Zigbee Technology Advantages and Disadvantages | ZigBee Technology Architecture and Its Applications - A Plus Topper