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Zigbee Technology

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Abstract—This paper aims at presenting the concept of ZigBee, the name of a specification for a suite of high level communication protocols using small, low-power digital radios based on the IEEE802.15.4-2006 standard for wireless personal area networks (WPANs),such as wireless headphones connecting with cell phones via short-range radio. The technology is intended to be simpler and less expensive than other WPANs, such as Bluetooth. ZigBee is targeted at radio-frequency (RF) applications that require a low data rate, long battery life, and secure networking.

The ZigBee communication is a communication technology to connect local wireless nodes and provides high stability and transfer rate due to data communication with low power. In the nodes away from coordinator in one PAN, the signal strength is weak causing the network a shortage of low performance and inefficient use of resources due to transferring delay and increasing delay time and thus cannot conduct seamless communication.

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1. INTRODUCTION

In the wireless environment, the signal strength which is sent by coordinators can be weakened as distance from it increases, causing communication with target nodes to become difficult and abuse of the wireless resources. Therefore, it is difficult to perform stable and reliable wireless communication with wide range nodes. It is not easy to use the wireless resources using location data because the coordinator cannot search the location of node. Also,

Figure 1. Zigbee

the wireless link can occur to the signal attenuation by distance and the wireless signal fading by the transferring media. Under the main goal to provide low-power, cost effective, flexible, reliable and scalable wireless products Zigbee Alliance has been developing and standardizing the ZigBee network. Based on IEEE 802.15.4.

2. ZIGBEE NETWORK & ARCHITECTURE

1. Search for a Radio Channel-The co-ordinator first searches for a suitable radio channel (usually the one which has least activity). This search can be limited to those channels that are known to be usable - for example, by avoiding frequencies in which it is known that a wireless LAN is operating.

2. Assign PAN ID- The Co-ordinator starts the network, assigning a PAN ID (Personal Area Network identifier) to the network. The PAN ID can be pre-determined, or can be obtained dynamically by detecting other networks operating in the same frequency channel and choosing a PAN ID that does not conflict with theirs.

3. The MAC sub layer is capable of single-hop reliable communications. As a rule, the security level it is touse is specified by the upper layers.

4. The network layer manages routing, processing received messages and being capable of broadcasting requests. Outgoing frames will use the adequate link key according to the routing, if it is available; otherwise, the network key will be used to protect the payload from external devices.

5. The application layer offers key establishment and transport services to both ZDO and applications. It is also responsible for the propagation across the network of changes in devices within it, which may originate in the devices themselves (for instance, a simple status change) or

170

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in the trust manager (which may inform the network that a certain device is to be eliminated from it).
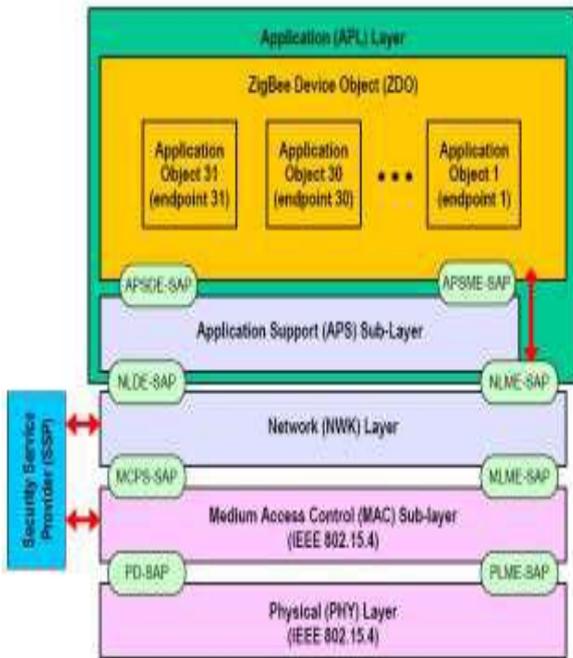

Figure 2. Layered Architecture of ZigBee

3. ZIGBEE DEVICE TYPES

1) ZigBee coordinator (ZC): The most capable device, the coordinator forms the root of the network tree and might bridge to other networks. There is exactly one ZigBee coordinator in each network since it is the device that started the network originally. It stores information about the network, including acting as the Trust Center & repository for security keys.

2) ZigBee Router (ZR): As well as running an application function, a router can act as an intermediate router, passing on data from other devices.

3) ZigBee End Device (ZED): Contains just enough functionality to talk to the parent node (either the coordinator or a router); it cannot relay data from other devices. This relationship allows the node to be asleep a significant amount of the time thereby giving long battery life. The least amount of memory, and therefore can be less expensive to manufacture than ZR or ZC.
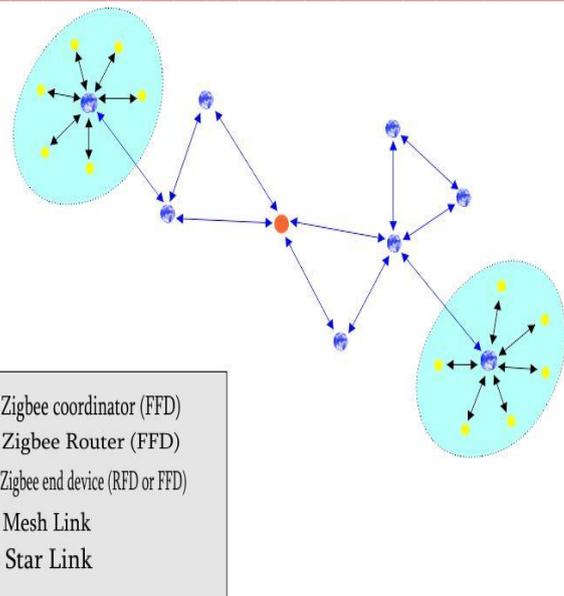

Figure 3. Zigbee device types

4. ZIGBEE vs BLUETOOTH

ZigBee looks rather like Bluetooth but is simpler, has a lower data rate and spends most of its time snoozing. This characteristic means that a node on a ZigBee network should be able to run for six months. The operational range of ZigBee is 10-75m compared to 10m for Bluetooth. ZigBee sits below Bluetooth in terms of data rate. The data rate of ZigBee is 250kbps at 2.4GHz, 40kbps at 915MHz and 20kbps at 868MHz whereas that of Bluetooth is 1Mbps.ZigBee uses a basic master-slave configuration suited to static star networks of many infrequently used devices that talk via small data packets. It allows up to 254 nodes. Bluetooth's protocol is more complex since it is geared towards handling voice, images and file transfers in ad hoc networks. Bluetooth devices can support scatternets of multiple smaller non-synchronized networks (piconets). It only allows up to 8 slave nodes in a basic master-slave piconet set-up. When ZigBee node is powered down, it can wake up and get a packet in around 15 msec whereas a Bluetooth device would take around 3sec to wake up and respond.

5. ADVANTAGES

- Standards based
- Low cost
- Can be used globally
- Reliable and self healing
- Supports large number of nodes
- Very long battery life
- Secure
- Large network capacity

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6. DISADVANTAGES

- Replacement with Zigbee compliant appliances can be costly.
- No more secure than a typical 802.11 wireless network.
- Can be confusing at first for the homeowner.

7. APPLICATIONS OF ZIGBEE TECHNOLOGY

1. Wireless Sensor Network For Multi-Storey Building.

2. Zigbee Technology is not limited to a certain level but because of being cost-effective.

3. low-power battery and wireless connectivity.

8. FUTURE SCOPE

- Monitoring anti collision between trains using zigbee
- Border security
- Structural health
- Earthquake , floods
- Traffic control

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