

## 802.15.4 - Zigbee

### About ZigBee:

ZigBee is the name for a short-range, low-power, low-cost, low-data-rate and wireless multi-hop networking technology standard. The features of ZigBee networks include self-organization, support for multi-hop routed networking topologies, interoperable application profiles, and security based on the Advanced Encryption Standard (AES). ZigBee is a type of Low Rate – Wireless Personal Area Network (LR-WPAN) technology and is built upon the lower layers of the IEEE 802.15.4 LR-WPAN standard. While the 802.15.4 standard defines the lower-level Physical (PHY) and Media Access Control (MAC) layers, the ZigBee Alliance standard defines the higher-level Network and Application layers as well as the security services.

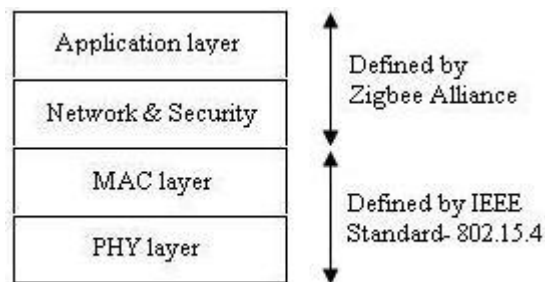


Image Source: Google Images

### Basic Layer operations:

- **PHY Layer:** The Physical Layer provides the basic radio communication capabilities.
- **MAC Layer:** MAC Layer provides reliable single-hop transmission, monitoring and accessing the wireless communications medium to coordinate the transmission of data from the higher layers.
- **Network and Security Layer:** Network Layer provides routing and multi-hop transmission for creating more complex topologies. Security Services Provider establishes the trust infrastructure of the network and provides essential security services such as cryptographic key management and admission control for nodes joining a network.
- **Application Layer:** Application Layer provides device and network management functions as well as message formats.

#### **Generic 802.15.4 LR-WPAN nodes:**

**1) Reduced Function Devices (RFD):** These are reduced complexity nodes with relatively limited memory, processing, and power capabilities. They can only serve as End Devices in a network and cannot perform the more complex roles of Router or Coordinator.

**2) Full Function Devices (FFD):** These devices have the resources to perform more complex task such as Coordinator or Router but can also be an End Device in a network.

#### **The primary components of a ZigBee LR-WPAN:**

**1) ZigBee Coordinator:** Also referred to more generically as the PAN Coordinator, this device is responsible for performing critical functions such as starting a PAN network, assigning device addresses, and controlling the PAN formation and operation. There can be only one Coordinator per ZigBee network, and the Coordinator must be an FFD.

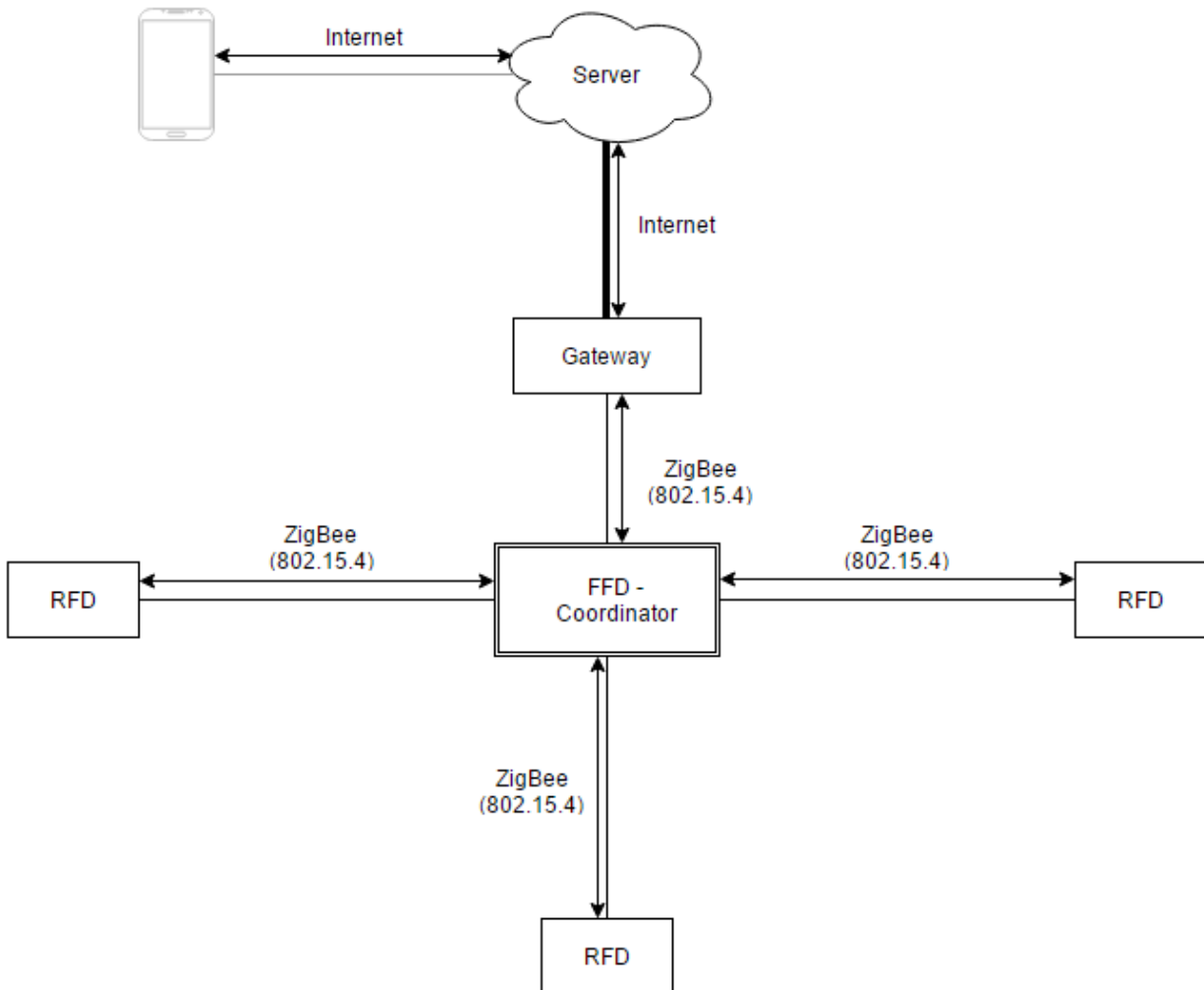
**2) ZigBee Router:** A Router has the resources to execute routing algorithms and forward message to and from ZigBee devices. It is capable of establishing and maintaining multiple connections to children and parent nodes. A Router must be an FFD.

**3) ZigBee Trust Center (ZTC):** The ZTC is the central component in the ZigBee security architecture and is trusted by all other ZigBee devices. It provides the vital services of trust management, device management, and network management.

**4) ZigBee End Device (ZED):** An End Device can be an RFD or an FFD but is a leaf node in the network and does not perform any of the other ZigBee device functions of Router, Coordinator, Trust Center, or Gateway.

**5) ZigBee Gateway:** A gateway node serves as a bridge between a ZigBee network and another network (such as a wired Ethernet network) and performs protocol conversion as necessary.

### DESIGN of the IOT Smart Home Network:



1. **FFD:** It is our primary device which acts as a Coordinator and Trust Center. This device is used by the end devices to communicate with the user or the cloud service.
2. **RFD:** It is the end device which communicates with the Coordinator, requesting and providing information. These devices consist of Thermostats, Gas detectors, Water level detector, etc.
3. **Gateway:** Used to convert
4. **Server:** The server which communicates with the device and coordinator. It is hosted by a third party provider, hence is considered "untrustworthy."
5. **Mobile Device:** Used by the user to access the Smart Home device to gain information and send requests. It is connected to the cloud service through the Internet, thus it's imperative that this communication be made secure.