

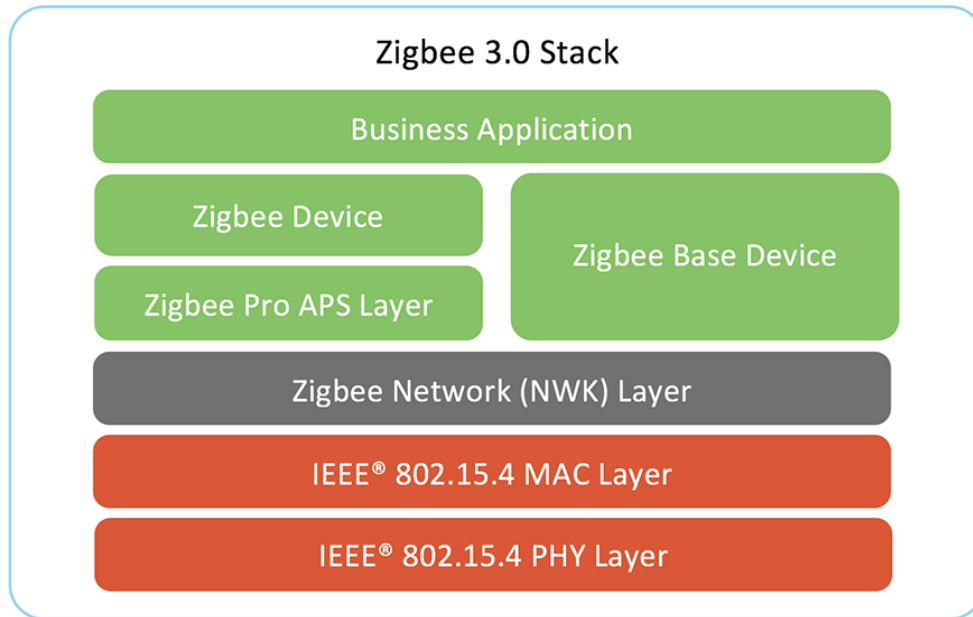
## Zigbee

- Zigbee is a wireless technology developed as an open global standard to address the unique needs of low-cost, low-power wireless IoT networks.
- The Zigbee standard operates on the IEEE 802.15.4 physical radio specification and operates in unlicensed bands including 2.4 GHz, 900 MHz and 868 MHz.

- **Zigbee Advantage:**

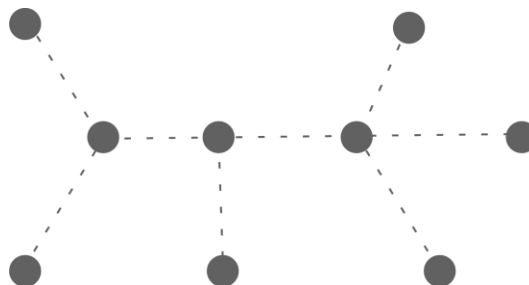


- The Zigbee 3.0 protocol is designed to communicate data through noisy RF environments that are common in commercial and industrial applications.
  - *Version 3.0* builds on the existing ZigBee standard but unifies the market-specific application profiles to allow all devices to be wirelessly connected in the same network, irrespective of their market designation and function.
  - Furthermore, a *ZigBee 3.0* certification scheme ensures the interoperability of products from different manufacturers.
  - Connecting ZigBee 3.0 networks to the IP domain opens up monitoring and control from devices such as smartphones and tablets on a LAN or WAN, including the Internet, and brings the true Internet of Things to fruition.
  - Zigbee protocol features include:
    - 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
- **Zigbee Stack:**
    - The Zigbee 3.0 software stack incorporates a ‘base device’ that provides consistent behavior for commissioning nodes into a network. A common set of commissioning methods is provided, including Touchlink, a method of proximity commissioning.



- Zigbee 3.0 provides enhanced network security. There are two methods of security that give rise to two types of network:
  - Centralized security: This method employs a coordinator/trust center that forms the network and manages the allocation of network and link security keys to joining nodes.
  - Distributed security: This method has no coordinator/trust center and is formed by a router. Any Zigbee router node can subsequently provide the network key to joining nodes.

- **Mesh Network:**



- A key component of the Zigbee protocol is the ability to support mesh networking.
- In a mesh network, nodes are interconnected with other nodes so that multiple pathways connect each node.
- Connections between nodes are dynamically updated and optimized through sophisticated, built-in mesh routing table.

- Mesh networks are decentralized in nature; each node is capable of self-discovery on the network.
  - Also, as nodes leave the network, the mesh topology allows the nodes to reconfigure routing paths based on the new network structure.
  - The characteristics of mesh topology and ad-hoc routing provide greater stability in changing conditions or failure at single nodes.
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- **Zigbee Applications:**
    - Zigbee enables broad-based deployment of wireless networks with low-cost, low-power solutions.
    - It provides the ability to run for years on inexpensive batteries for a host of monitoring and control applications.
    - Smart energy/smart grid, AMR (Automatic Meter Reading), lighting controls, building automation systems, tank monitoring, HVAC control, medical devices and fleet applications are just some of the many spaces where Zigbee technology is making significant advancements.