SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE NAME :19EE603 IoT for Electrical Engineers

III YEAR /VI SEMESTER

Unit 3- Communication Interface

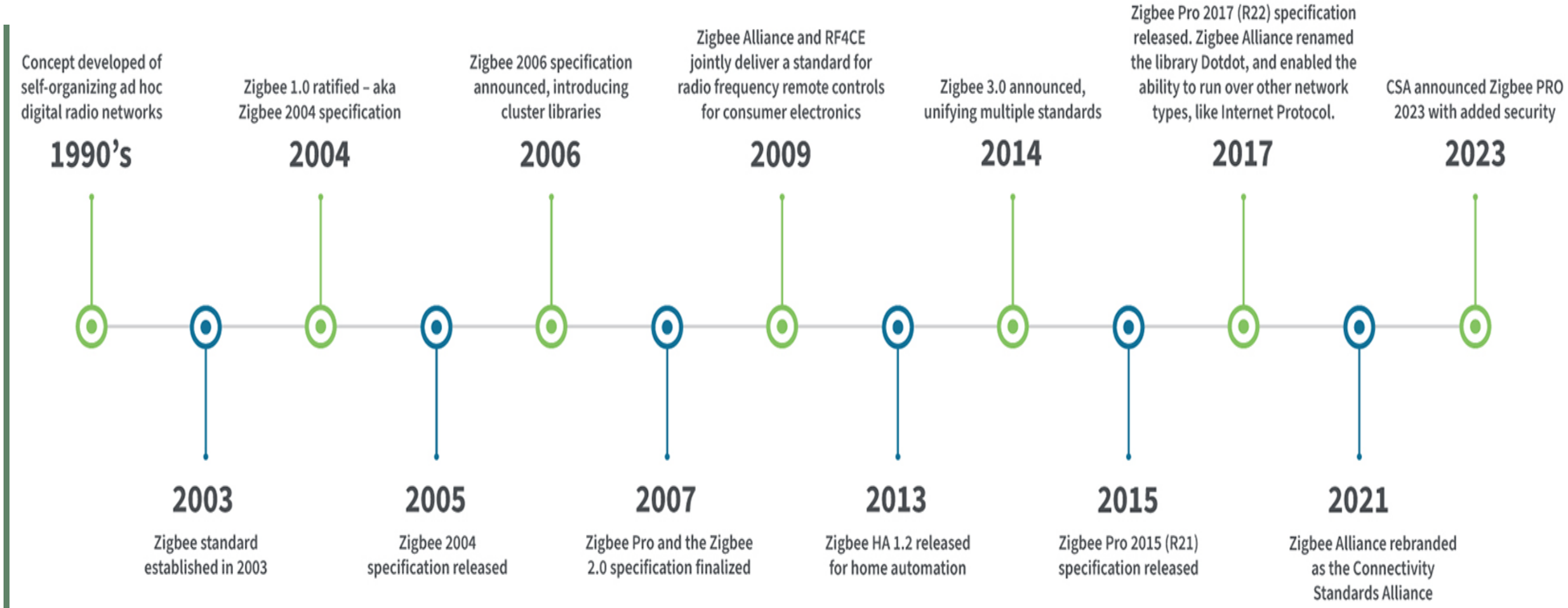
Zigbee

What is Zigbee??

Zigbee

- Zigbee is a wireless technology based on the IEEE 802.15.4 standard, designed for low-data-rate, low-power wireless communication

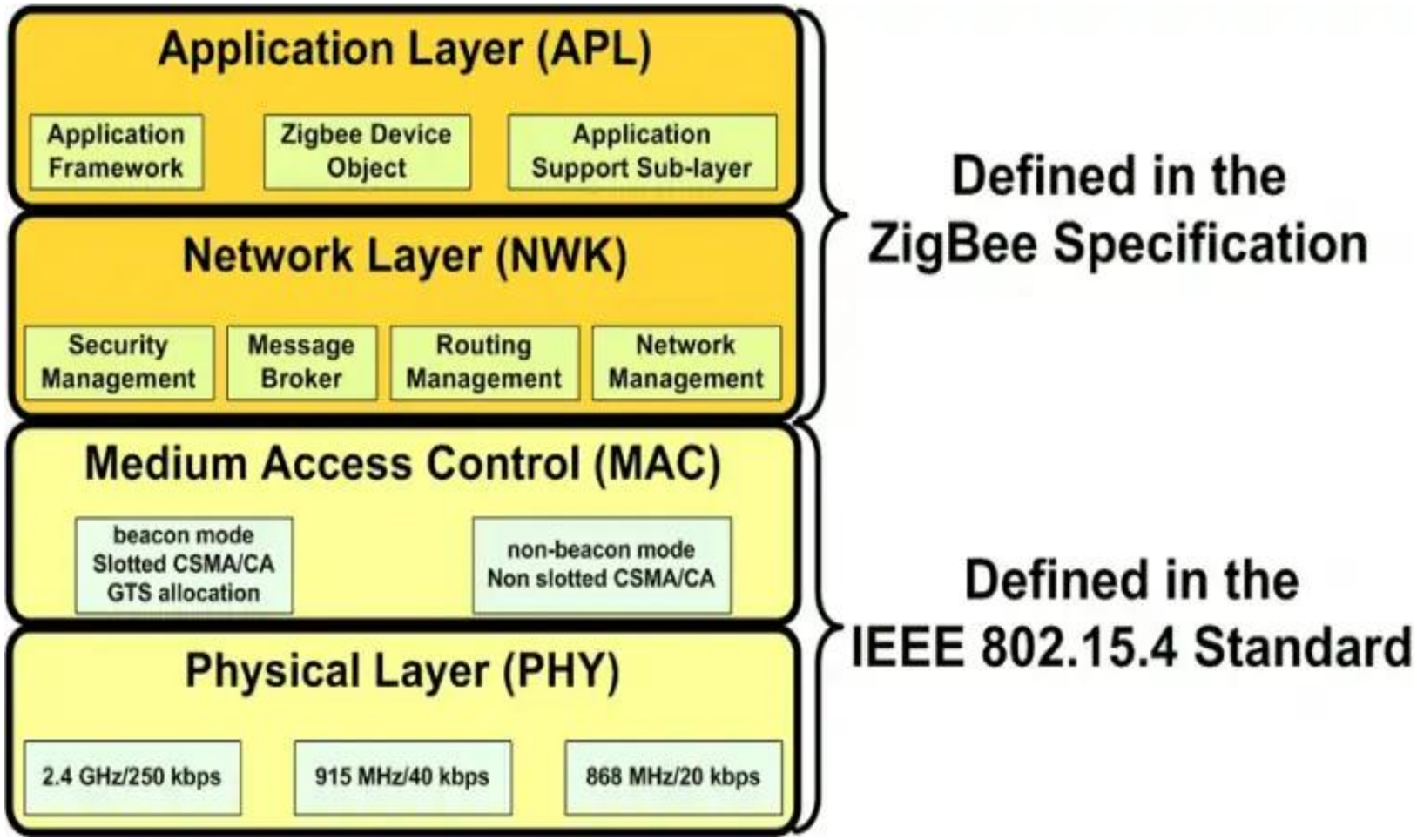
Zigbee Evolution



Role of Zigbee in IoT

- The specification is a packet-based protocol intended for low-cost, battery-operated devices and products. The Zigbee IoT protocol allows devices to communicate data seamlessly in a variety of network topologies using extremely limited power.

Zigbee Protocol



Zigbee Protocol - Continued

- **Physical Layer:** Controls the radio transceiver, selects channel frequency, and communicates using packets containing synchronization, header, and payload data.
- **MAC Layer:** Interfaces with the network layer, manages synchronization, and transmits different frame types (Beacon, Data, Acknowledge, and Command) with security and addressing information.
- **Network Layer:** Handles network formation, topology selection, and routing. Contains addressing and control information.
- **Application Support Sub-Layer:** Provides services to upper layers via Service Access Points (SAP).
- **Application Layer:** Hosts application objects, ZigBee Device Objects (ZDOs), and profiles defining device roles and communication.

Advantages & Disadvantages

Advantages:

- **Low Power & Cost:** Ideal for battery-powered, cost-effective applications.
- **Mesh Networking:** Self-healing and scalable.
- **Secure:** Uses AES-128 encryption.
- **Supports Many Devices:** Connects up to 65,000 nodes.
- **Interoperability:** Works across multiple manufacturers.

Disadvantages:

- **Low Data Rate:** Limited to 250 kbps.
- **Short Range:** Covers only 10–100 meters.
- **Interference Issues:** Operates in the crowded 2.4 GHz band.
- **Not for High-Bandwidth Uses:** Unsuitable for streaming or large data transfers

Applications

- **Green tech applications** - Zigbee mesh is an excellent choice for green technology applications such as solar and wind farms and EV charging networks.
- **Smart home** - In a smart home, a Zigbee network can control lights, door locks, smoke detectors, fans, appliances and more. In fact, Zigbee is employed by most large smart home ecosystem providers, including the Amazon Echo Plus, Samsung SmartThings and Signify (formerly Philips Lighting). Worldwide, there are hundreds of millions of Zigbee products in smart homes and buildings.
- **Smart energy** - Zigbee devices built to Zigbee Pro 2023 specifications can now share the same network as Smart Energy devices to improve the control and use of these devices.
- **Medical** - In a medical scenario, a patient can wear sensors that collect and communicate vitals such as heart rate, blood pressure and blood glucose levels wirelessly to a hospital.
- **Industrial automation** - Inside a building, Zigbee can be used to automate lighting control, HVAC, security and access control systems.

Assessment

- Which layer in the ZigBee protocol is responsible for network formation and routing?
  - Physical Layer
  - MAC Layer
  - Network Layer
  - Application Layer

- What is the maximum data rate of ZigBee?
  - 1 Mbps
  - 250 kbps
  - 500 kbps
  - 10 Mbps

References

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