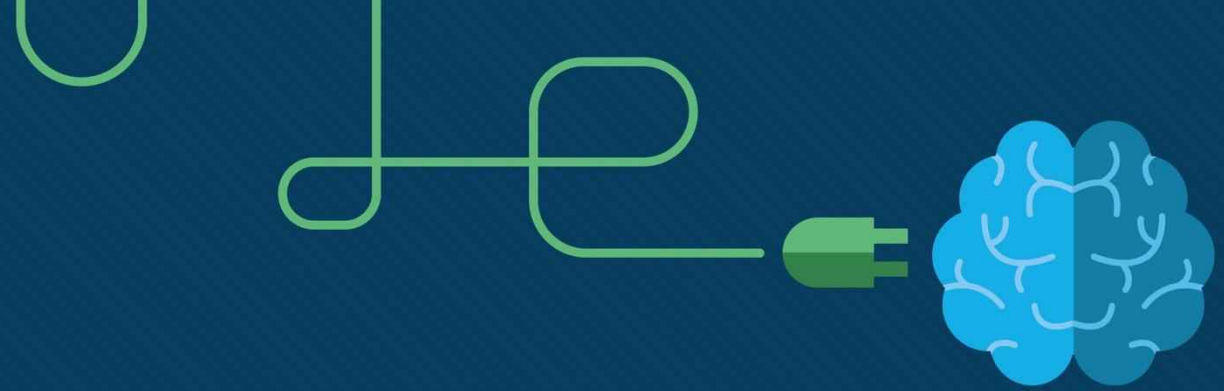

Wireless Protocols

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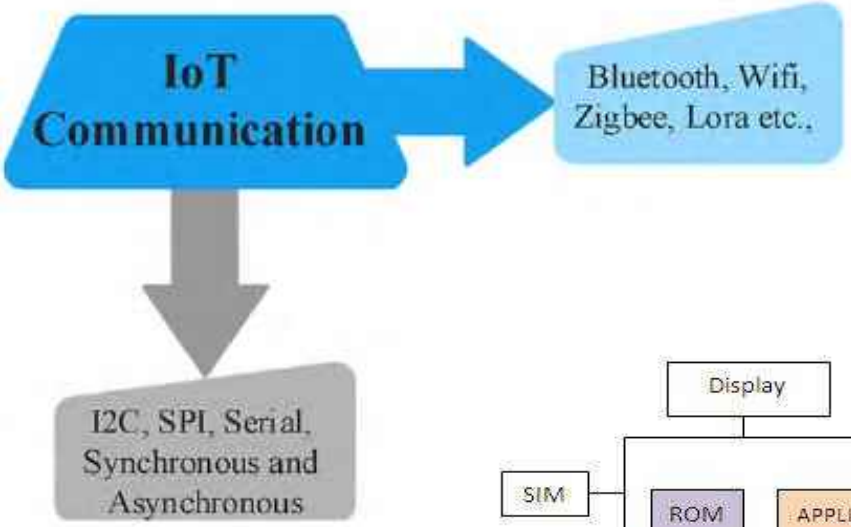
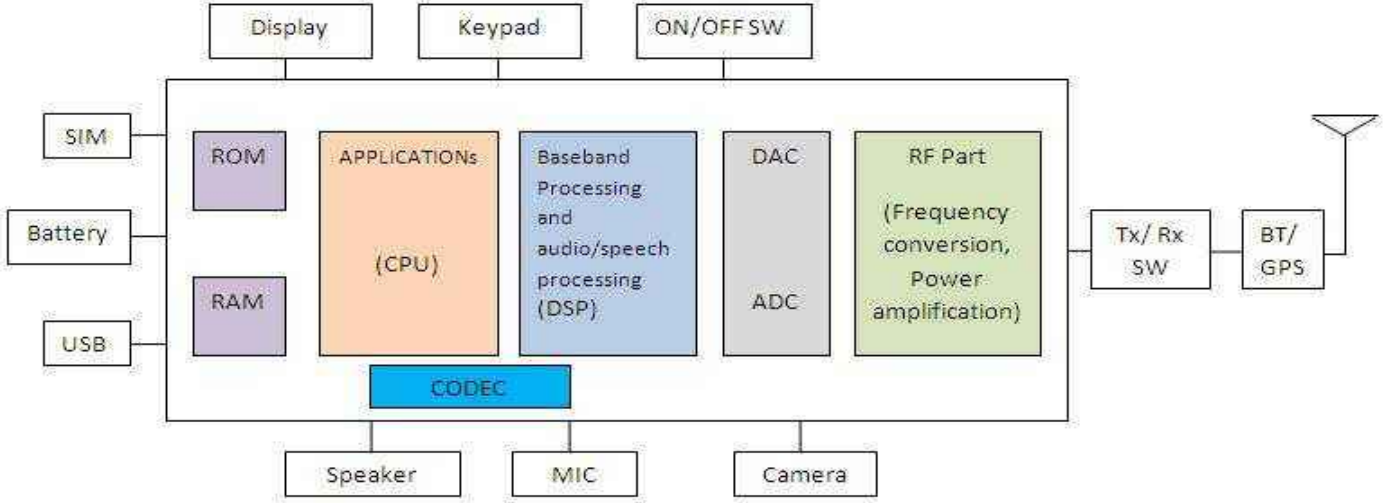
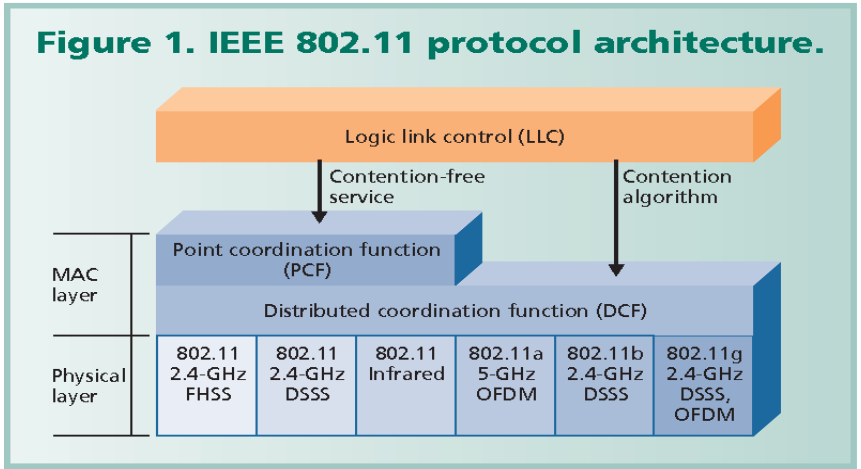

IoT Communication
Bluetooth, Wifi, Zigbee, Lora etc.,
I2C, SPI, Serial, Synchronous and Asynchronous

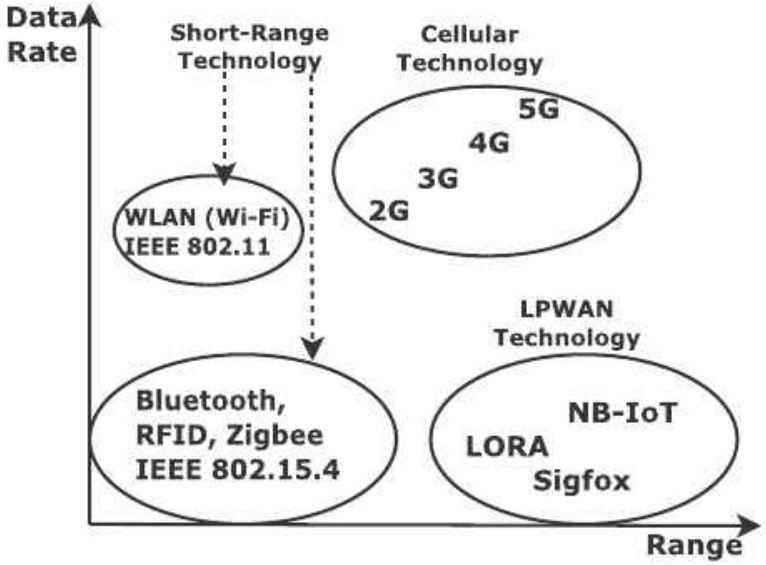

Display
Keypad
ON/OFF SW
SIM
Battery
USB
ROM
RAM
APPLICATIONs
(CPU)
Baseband Processing and audio/speech processing (DSP)
DAC
ADC
RF Part
(Frequency conversion, Power amplification)
Tx/ Rx SW
BT/ GPS
CODEC
Speaker
MIC
Camera

IEEE 802.11 Protocol

- Refers set of standards that define communication for wireless LANs (wireless local area networks, or WLANs). The technology behind 802.11 is branded to consumers as Wi-Fi. As the name implies, IEEE 802.11 is overseen by the IEEE, specifically the IEEE LAN/MAN Standards Committee (IEEE 802).



Parameter	ZigBee	WiFi	Bluetooth	LoRaWAN	Sigfox
Standard	IEEE 802.15.4	IEEE 802.11	IEEE 802.15.1, Bluetooth Special Interest Group (SIG)	LoRa alliance	Sigfox
Modulation	DSSS, QPSK	DSSS, OFDM	GFSK	CSS	BPSK
Frequency	ISM: 868 MHz, 2.4 GHz	ISM 2.4GHz, 5GHz	2.4GHz	Varies across countries	Varies across countries
Coverage	100m	100m	100m (depends on class and version)	10Km	40Km

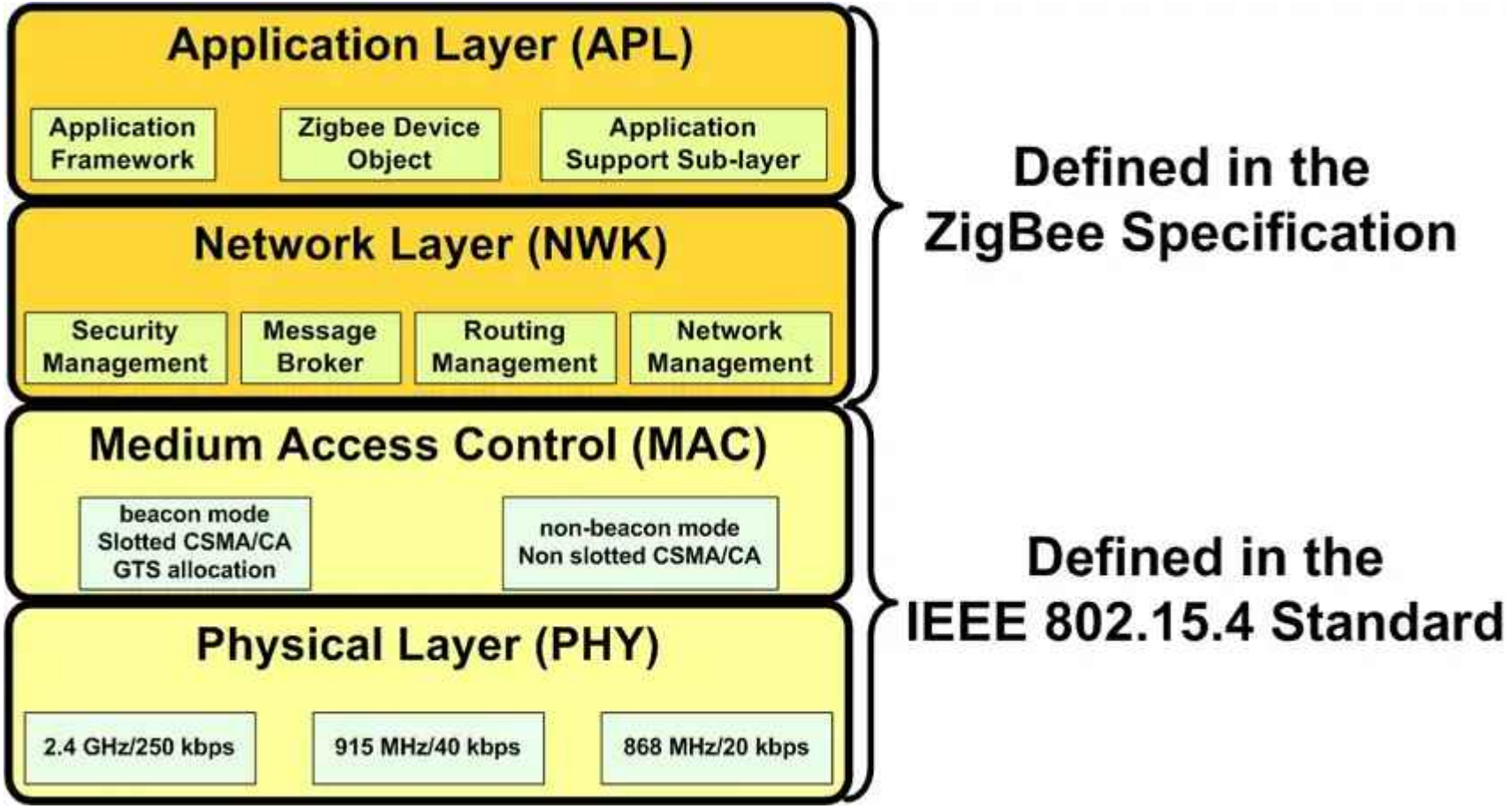


Bluetooth

Bluetooth network technology creates a personal area network (PAN) by wirelessly connecting mobile devices over a short distance. The Bluetooth architecture has its own independent model with a stack of protocols; it does not follow the standard OSI or TCP/IP models.

ZibBee

The Zigbee 3.0 protocol is an IEEE 802.15.4 specification that supports a 2.4 GHz frequency band.
Features of Zigbee 3.0.
Low power: Devices that comply with Zigbee 3.0 consume less power and transmit data at a slower rate.
For IoT devices, long-lasting batteries are required. As a result, the Internet of Things (IoT) network extensively uses this standard.
Reliable and robust: The mesh topology of the Zigbee 3.0 network eliminates single points of failure and ensures packet delivery reliability.
Scalable: Devices can be added to a Zigbee 3.0 network anytime.
It is a secure network because it employs AES-128 encryption.
Global standard: Zigbee 3.0 devices use the 2.4 GHz frequency band, which is widely used worldwide. As a result, it has become the industry standard around
the world.

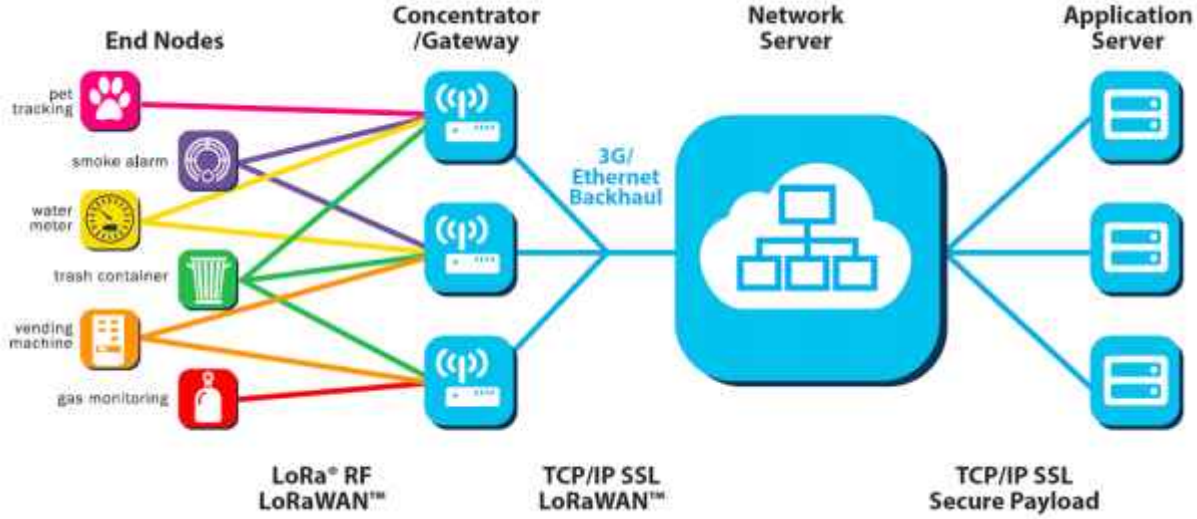

Application Layer (APL)
Application Framework
Zigbee Device Object
Application Support Sub-layer
Network Layer (NWK)
Security Management
Message Broker
Routing Management
Network Management
Medium Access Control (MAC)
beacon mode Slotted CSMA/CA GTS allocation
non-beacon mode Non slotted CSMA/CA
Physical Layer (PHY)
2.4 GHz/250 kbps
915 MHz/40 kbps
868 MHz/20 kbps
Defined in the ZigBee Specification
Defined in the IEEE 802.15.4 Standard

Wi-Fi

Wi-Fi is a technology that transfers data through radio waves that can make small gadgets exchange data connected within a small router. Wi-Fi uses the Institute of Electrical and Electronics Engineers' (IEEE) 802.11 standards for effective data transmission.
IEEE 802.11 devices have the primary benefit of making it easier to deploy local area networks (LANs) at a lower cost. They can host wireless LANs in outdoor areas and airports, where running cables to every device isn't practical.

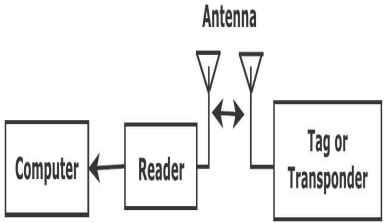
LoRa

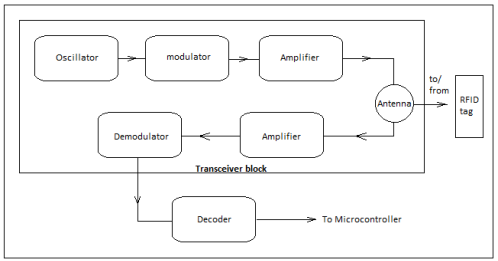
LoRa is a long-range wireless communication technology derived from the CSS chirp-based spread spectrum.

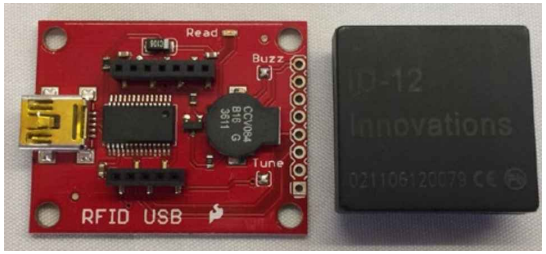


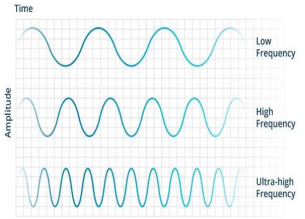
Radio Frequency Identification (RFID)

- Radio frequency identification uses a passive device (sometimes called an RFID tag) to communicate data using radio frequencies through electromagnetic induction.
- When the tag is placed near the reader, the reader emits a radio signal; the tag can use the electromagnet energy to transmit a nonvolatile message embedded in the antenna, in the form of radio signals, which is then converted to an alphanumeric string.



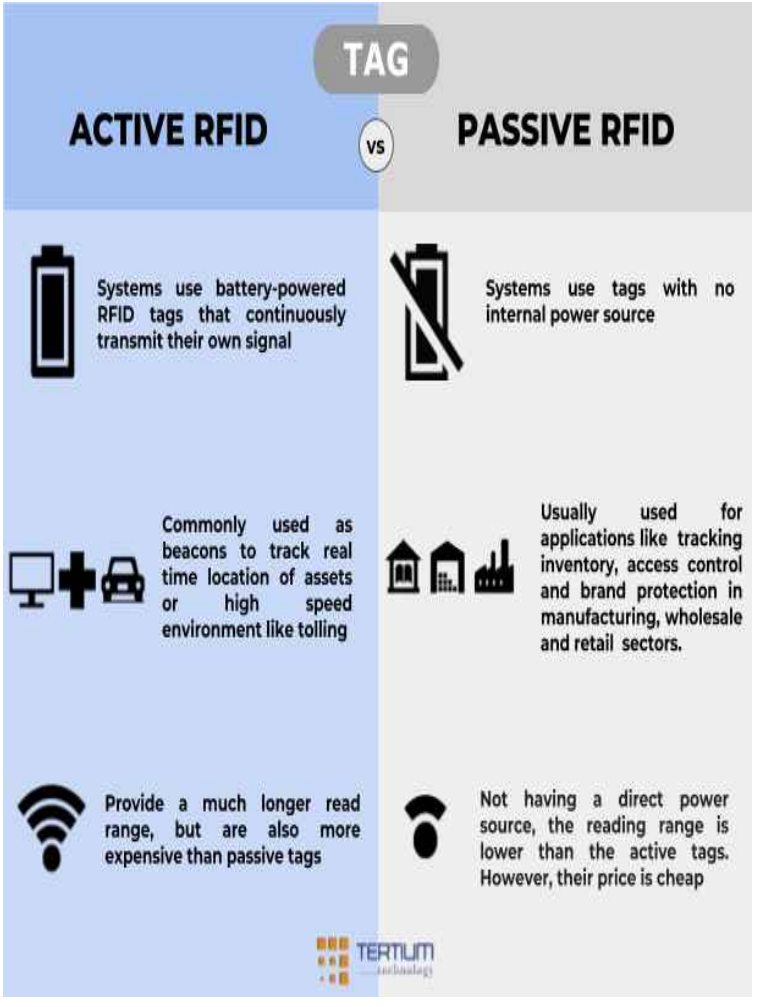






Active and Passive RFID

- Two broad categories denote RFID systems: active and passive RFID tags. The main difference between active and passive RFID tags is that an active tag has a battery while a passive tag does not.



	Passive	Active
Read Range	Up to 100+ feet (fixed readers) Up to 50+ feet (handheld readers)	Up to 300 feet or more
Power	No power source	Battery powered
Tag Life	Up to 10 years or more depending upon the environment the tag is in	Typically 3-5 years depending upon the tag broadcast rate
Tag Costs	$.10-4.00 or more depending upon quantity, durability, and form-factor	$10-50 depending upon quantity, options (motion sensor, tamper detection, temperature sensor), and form-factor
Ideal Use	For inventorying assets using handheld RFID readers (daily, weekly, monthly quarterly, annually). Can also be used with fixed RFID readers to track the movement of assets at choke-points as long as security is not a requirement.	For use with fixed RFID readers to perform real-time asset monitoring at choke-points or within zones. Typically necessary when security is a requirement.
Readers	Typically higher cost	Typically lower cost

LoRaWAN

- The LoRaWAN protocol is a Low Power Wide Area Networking (LPWAN) communication protocol that functions on LoRa. The LoRaWAN specification is open so anyone can set up and operate a LoRa network.
- **Characteristics of LoRaWAN technology:**
  - Long range communication up to 10 miles in line of sight.
  - Long battery duration of up to 10 years. For enhanced battery life, you can operate your devices in class A or class B mode, which requires increased\]\ downlink latency.
  - Low cost for devices and maintenance.
  - License-free radio spectrum but region-specific regulations apply.
  - Low power but has a limited payload size of 51 bytes to 241 bytes depending on the data rate. The data rate can be 0,3 Kbit/s – 27 Kbit/s data rate with a 222 maximal payload size.

Tasks

- Propose wireless local area network of IoT Devices
- Identify different application, libraries and operating system used to configure and develop the LAN.