

21ES614 – Internet of Things

Sivraj P, Asst. Professor,
Dept. of EEE, Amrita School of Engineering
Amrita Vishwa Vidyapeetham

Syllabus

Unit 1

Introduction to IoT - Definitions, frameworks and key technologies. Functional blocks of IoT systems: hardware and software elements- devices, communications, services, management, security, and application. Challenges to solve in IoT

Unit 2

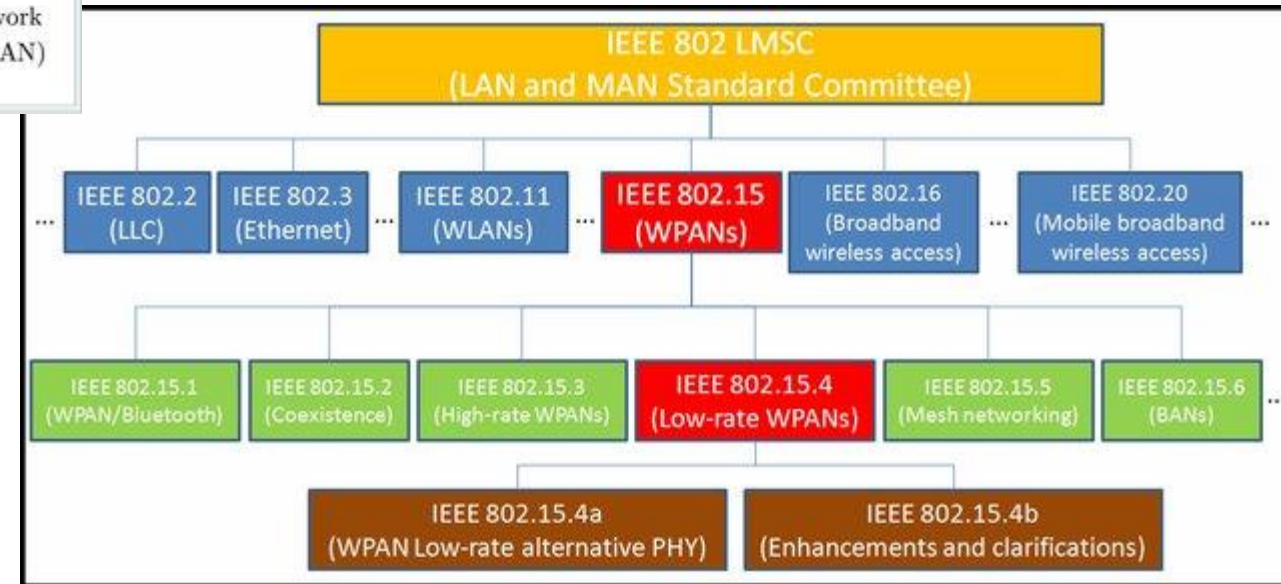
Basics of Networking & Sensor Networks - Applications, challenges - ISO/OSI Model, TCP/IP Model, Sensor network architecture and design principles, IoT technology stack, Communication models. Communication Protocols - Overview of protocols in each layer, Application protocols for the transfer of sensor data, Infrastructure for IoT: LoRa-Wan, 6LoWPAN, 5G and Sigfox.

Unit 3

Introduction to Cloud, Fog and Edge Computing. Modern trends in IoT – Industrial IoT, Wearable. Applications of IoT - Smart Homes/Buildings, Smart Cities, Smart Industry, and Smart Medical care, Smart Automation etc.

IEEE 802 Standards

PHY / MAC	802.1							
	802.2							
	802.3 CSMA/CD ETHERNET	802.4 Token Passing Bus	802.5 Token Passing Ring	802.11 CSMA/CA WLAN	802.15 Wireless Personal Area Network (WPAN)	802.16 Broadband Wireless Access (BWA)	802.20 Mobile Broadband Wireless Access (MBWA)	802.22 Wireless Radio Access Network (WRAN)



Ref: https://en.wikipedia.org/wiki/IEEE_802

<http://dx.doi.org/10.13140/RG.2.2.20878.82245>

<https://www.researchgate.net/publication/41392302> Interconnection between 802154 Devices and IPv6 Implications and Existing Approaches

IEEE 802.3

- IEEE standards produced by the working group defining the physical layer and data link layer's media access control (MAC) of wired Ethernet

Name	Medium	Specified distance
1000BASE-CX	Shielded balanced copper cable	25 meters
1000BASE-KX	Copper backplane	1 meter
1000BASE-SX	Multi-mode fiber	220 to 550 meters dependent on fiber diameter and bandwidth
1000BASE-LX	Multi-mode fiber	550 meters
1000BASE-LX	Single-mode fiber	5 km
1000BASE-LX10	Single-mode fiber using 1,310 nm wavelength	10 km
1000BASE-EX	Single-mode fiber at 1,310 nm wavelength	~ 40 km
1000BASE-ZX	Single-mode fiber at 1,550 nm wavelength	~ 70 km
1000BASE-BX10	Single-mode fiber, over single-strand fiber: 1,490 nm downstream 1,310 nm upstream	10 km
1000BASE-T	Twisted-pair cabling (Cat-5, Cat-5e, Cat-6, Cat-7)	100 meters
1000BASE-TX	Twisted-pair cabling (Cat-6, Cat-7)	100 meters

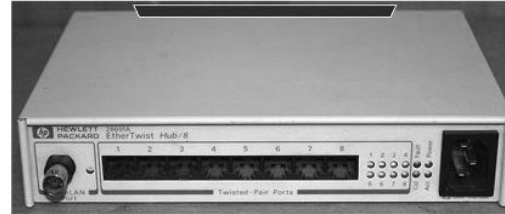
Ref: <https://medium.com/@kerryzhang/introduction-to-cisco-sfp-modules-for-gigabit-ethernet-7702dbae439>

https://en.wikipedia.org/wiki/IEEE_802.3

IEEE 802.3 – Network Devices



Repeater



Hub



Bridge



Switch



Router



Gateway

IEEE 802.11

- IEEE standards that specifies the set of media access control (MAC) and physical layer (PHY) protocols for implementing wireless local area network (WLAN) computer communication

Standard	Freq Band	Bandwidth	Modulation	Max Data Rate
802.11	2.4 GHz	20 MHz	DSSS, FHSS	2 Mbps
802.11b	2.4 GHz	20 MHz	DSSS	11 Mbps
802.11a	5.0 GHz	20 MHz	OFDM	55 Mbps
802.11g	2.4 GHz	20 MHz	DSSS, OFDM	55 Mbps
802.11n	2.4 GHz, 5.0 GHz	20 MHz, 40 MHz	OFDM	600 Mbps
802.11ac	5.0 GHz	20 MHz, 40 MHz, 80 MHz, 160 MHz	OFDM	6.93 Gbps

IEEE Standard	802.11a	802.11b	802.11g	802.11n	802.11ac	802.11ax
Year Released	1999	1999	2003	2009	2014	2019
Frequency	5GHz	2.4GHz	2.4GHz	2.4Ghz & 5GHz	2.4Ghz & 5GHz	2.4Ghz & 5GHz
Maximum Data Rate	54Mbps	11Mbps	54Mbps	600Mbps	1.3Gbps	10-12Gbps

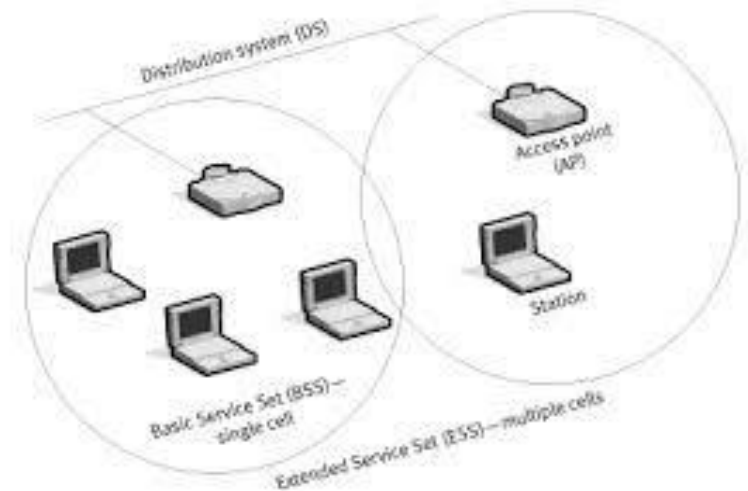
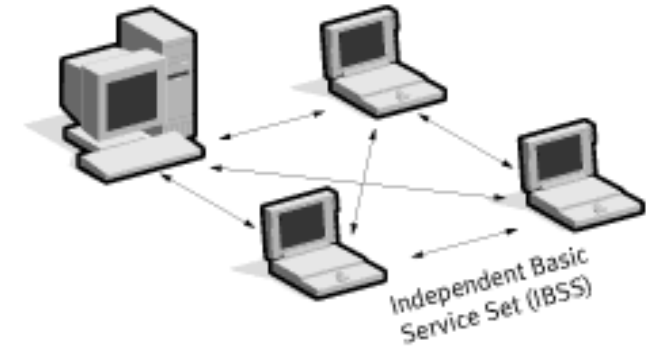
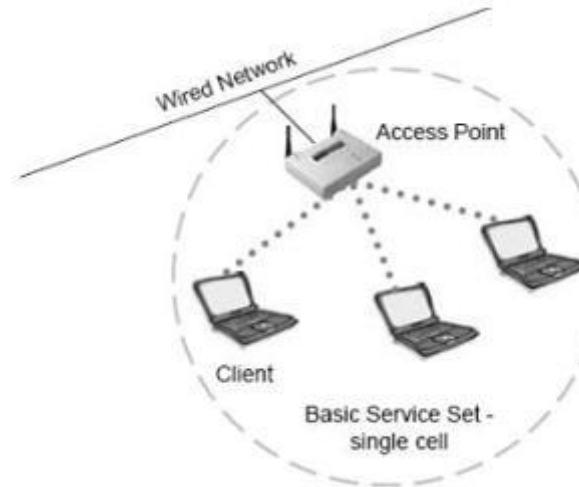
Ref: <http://bucarotechelp.com/networking/standards/81090201.asp>

<https://netspeedtest.in/wi-fi-standards-wi-fi-4-wi-fi-5-and-wi-fi-6/>

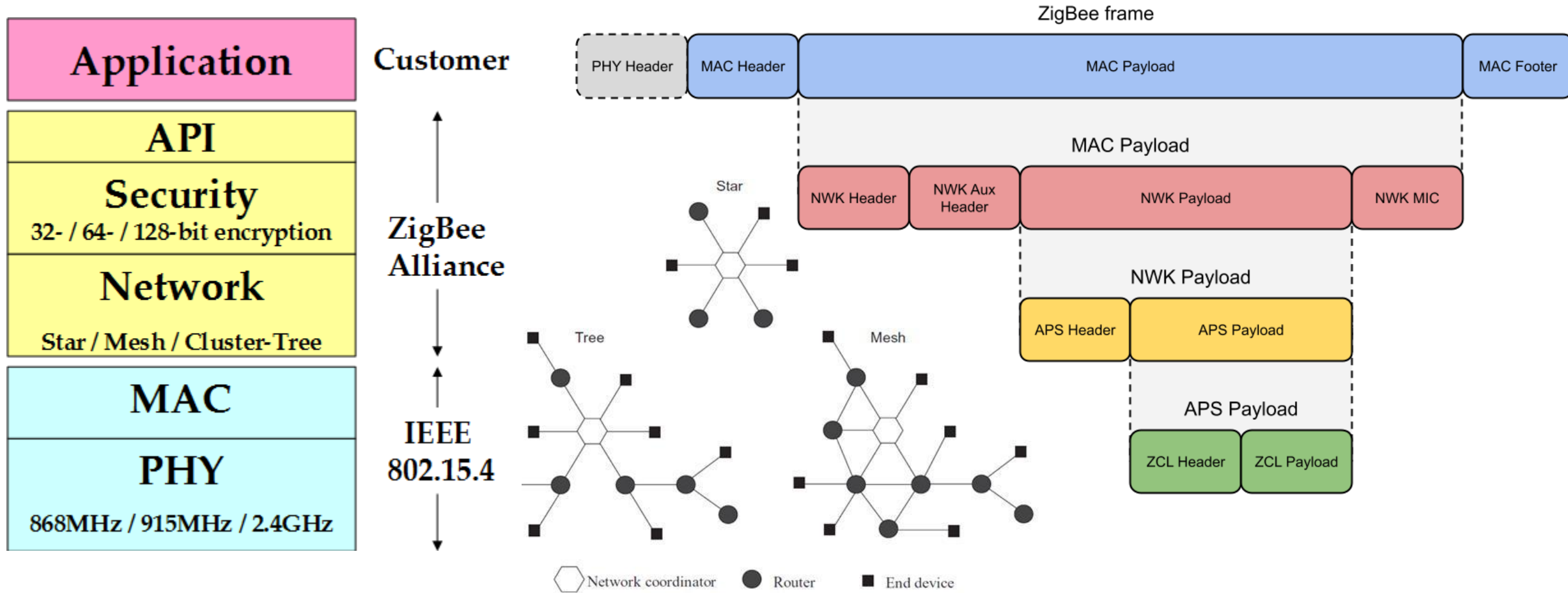
https://en.wikipedia.org/wiki/IEEE_802.11

IEEE 802.11 – Network Structure & Device

- Infrastructure & Adhoc
- Basic Service Set (BSS)
 - Independent BSS
 - Infrastructure BSS
- Extended Service Set
- Access Points



Industrial Wired & Wireless Networks – ZigBee

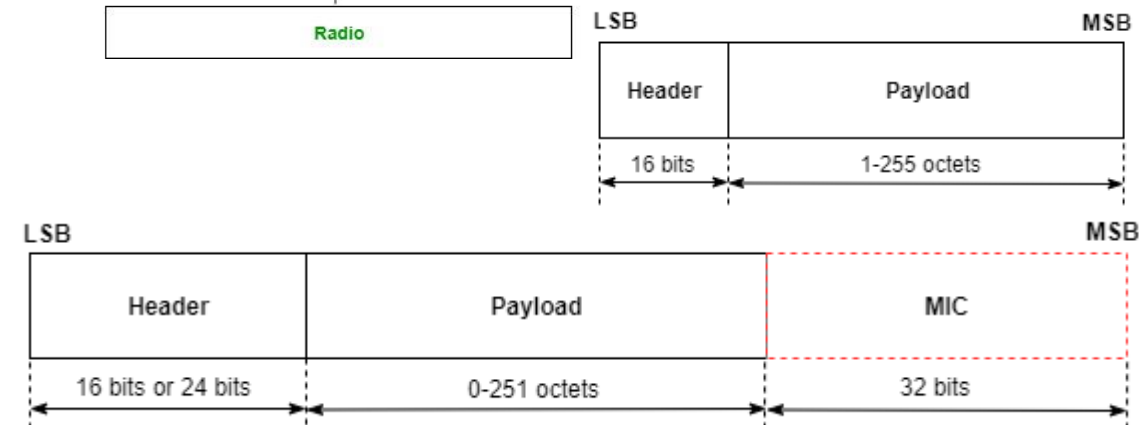
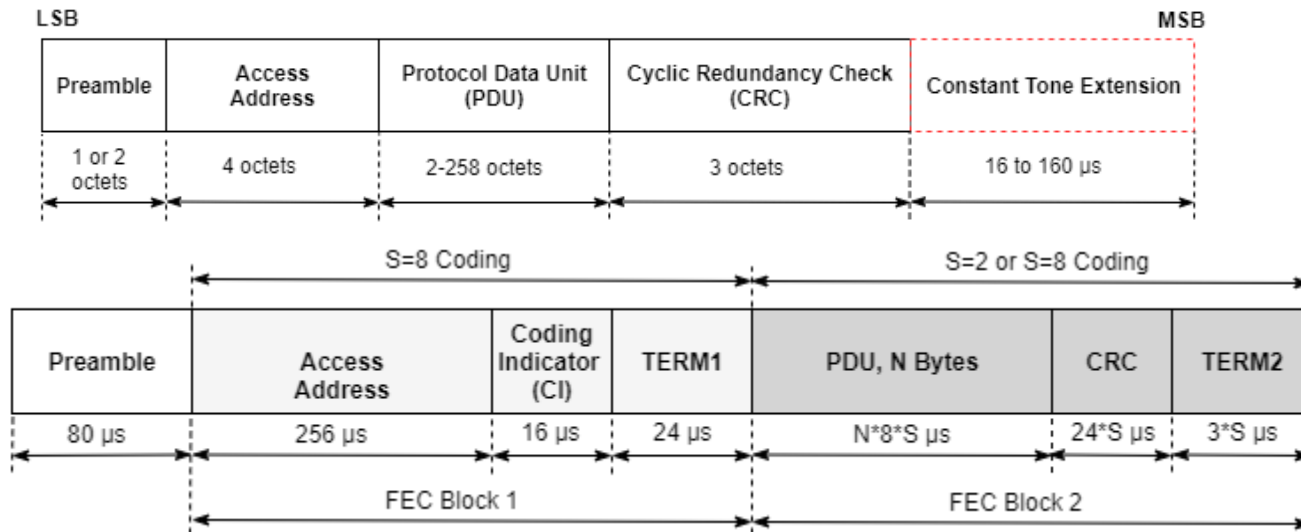
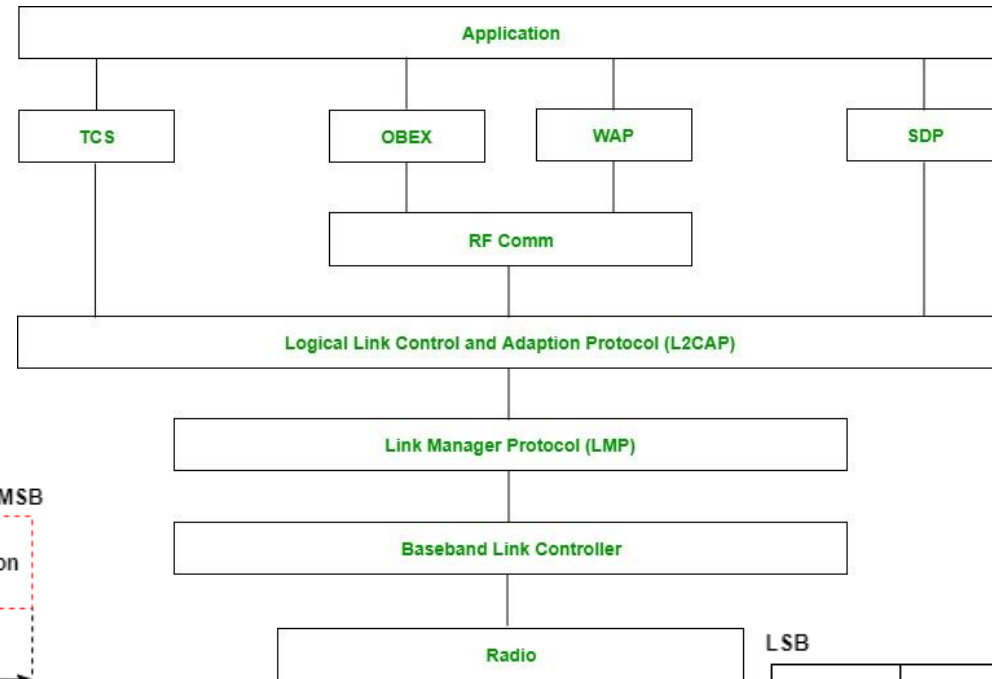
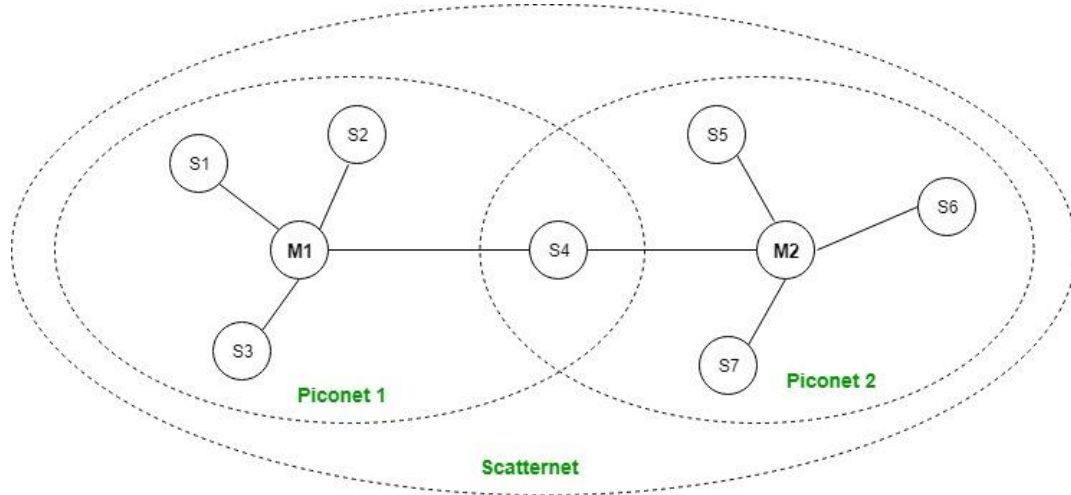


Ref: <https://smartify.in/knowledgebase/zigbee-protocol-explained/>
<https://www.netguru.com/blog/the-zigbee-protocol>
<https://lucidar.me/en/zigbee/autopsy-of-a-zigbee-frame/>

12/19/2023

Department of EEE, Amrita School of Engineering, Coimbatore

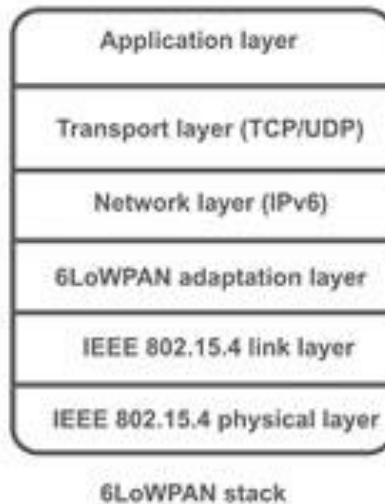
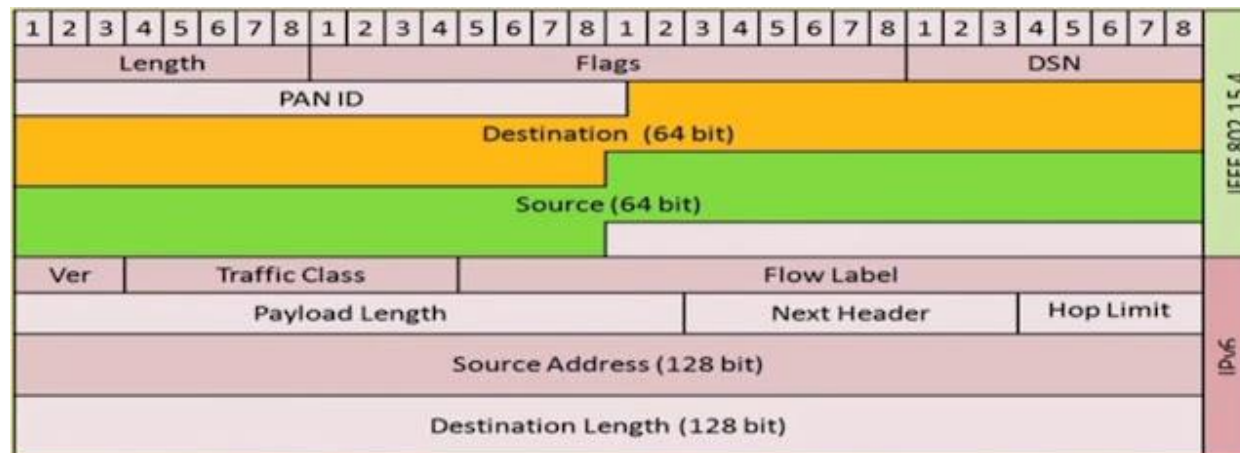
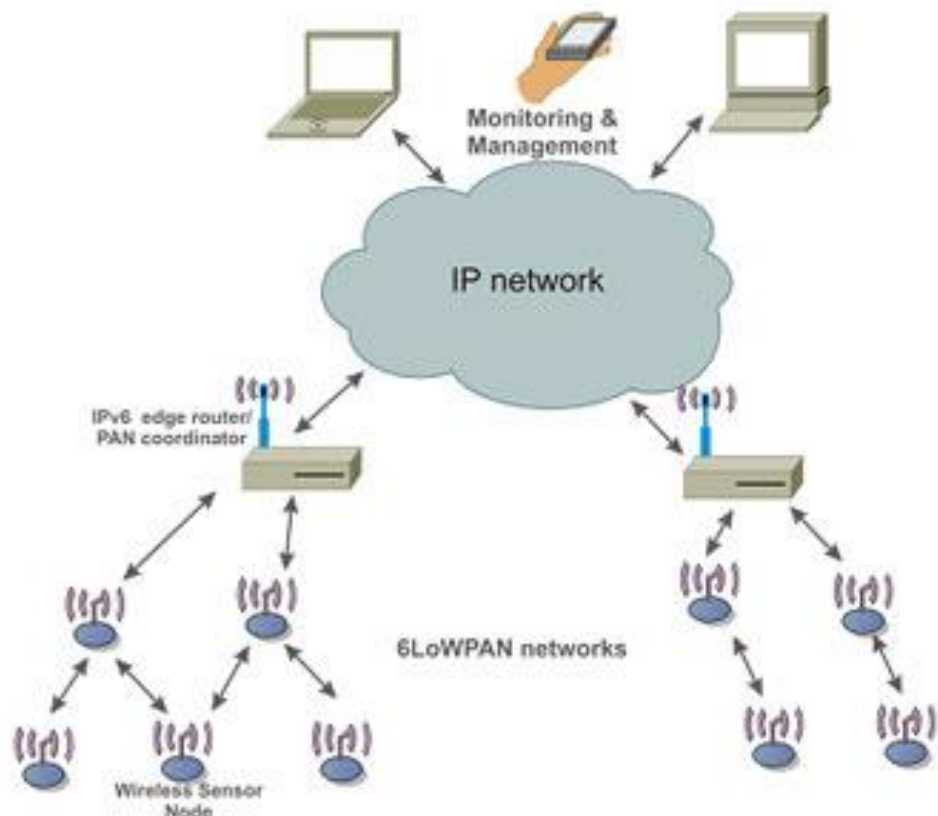
Industrial Wired & Wireless Networks – Bluetooth



Ref: <https://www.geeksforgeeks.org/bluetooth/>

<https://www.mathworks.com/help/bluetooth/ug/bluetooth-packet-structure.html>

Industrial Wired & Wireless Networks – 6LoWPAN



Ref: <https://www.ntirawen.com/2019/03/6lowpan-connectivity-protocols-in-iot.html>

<https://ernet.in/content/6lowpan>

12/19/2023

Additional communication technologies we use...

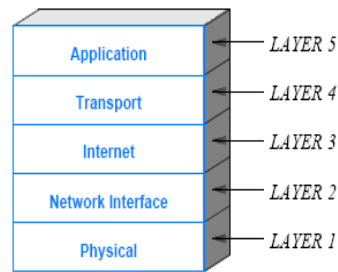
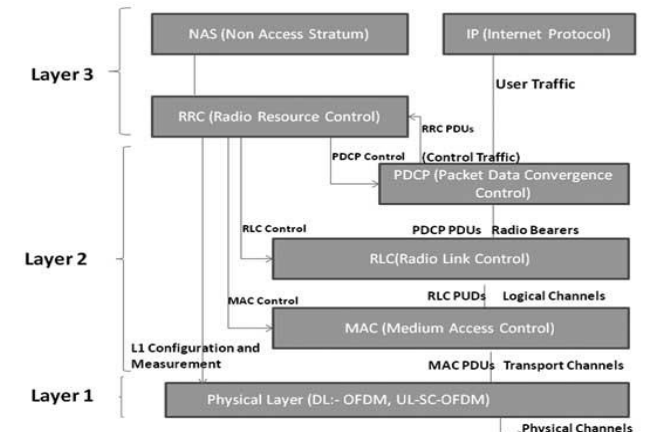
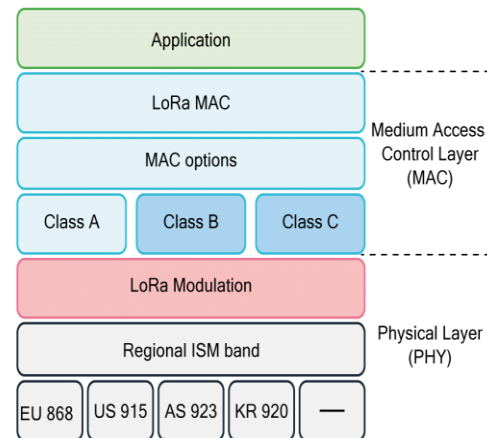
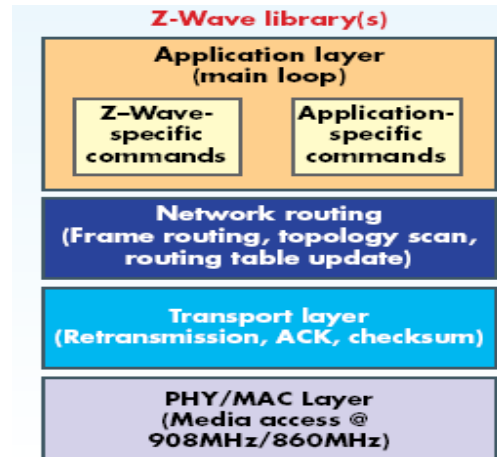
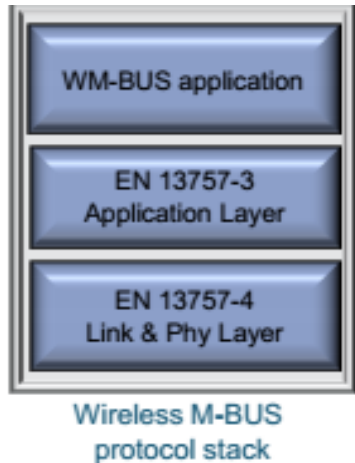
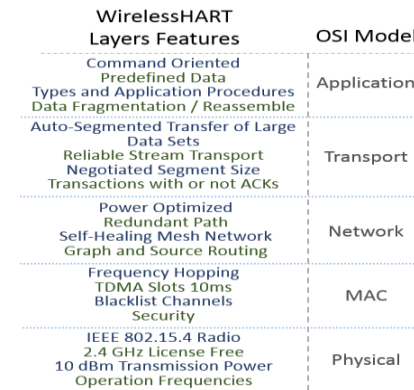
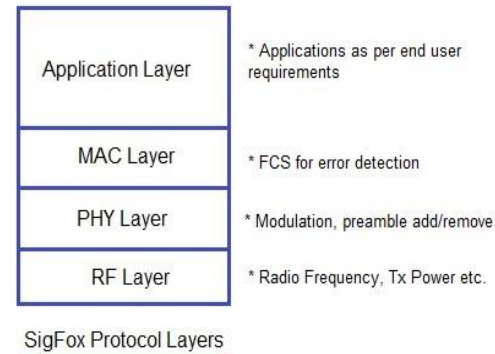
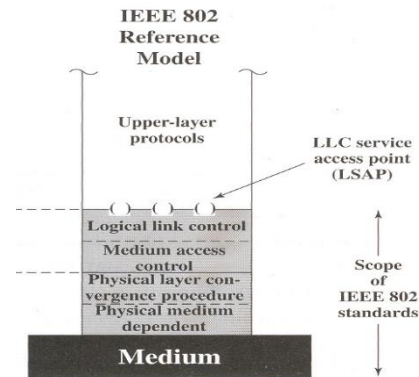


Figure 1.1 The layering model used with the Internet protocols (TCP/IP).



Thank You...