UNIT III

WPAN Technologies For IoT/M2M

A PAN (also known as a WPAN) is a network used for communication among intelligent gadgets that are physically close to a person (including smartphones, tablets, body monitors, and so on). PANs can be used to support wireless body area networks (WBANs) (also known as wireless medical body area networks (WMBANs) and medical body area network systems (MBANSs). Still, they can also be used to support other applications. Medical uses include vital sign monitoring, respiration monitoring, electrocardiography (ECG), pH monitoring, glucose monitoring, disability assistance, muscular tension monitoring, and artificial limb support, among others. WBANs' nonmedical applications include video streaming, data transfer, entertainment, and gaming.

A PAN's range is usually a few meters. The gadgets in question are sometimes referred to as short-range devices (SRDs). PANs can be used to communicate among personal devices (intrapersonal communication) or to connect to a higher-level network, such as the Internet. The following table highlights a rough comparison of three wireless technologies, highlighting the features of BANs/WBANs. WBAN technology can, to varying degrees, meet the following significant needs that the healthcare industry considers essential.

S.No.	**Sr.No**	**WBAN**	**WSN**	**Cellular Wireless Networks**
01.	Traffic	Application-specific	Sporadic/cyclic, modest data rate	Multimedia, high data rate
02.	Topology	Dynamic	Random, dynamic	Few infrastructures changes
03.	Configuration/ maintenance	Some flexibility Specialists are needed	Self-configurable, unattended operation	Managed by large organizations/ carriers
04.	Standardization	Multiple (IEEE) standards especially at lower layers	Relatively little standardization	Multiple international standards, ITU-T, ETSI, etc.

The following are the key wireless technologies and concepts that support IoT/M2M applications:

- **3GPP:** 3GPP brings together six telecommunications standard bodies, known as "organisational partners," and offers a stable environment for their members to generate the reports and specifications that define 3GPP technologies. These technologies are constantly advancing through what has come to be recognised as commercial cellular/mobile system generations.3GPP was originally the standards collaboration that was advancing Global System for Mobile Communication (GSM) platforms toward 3G. However, 3GPP has been the main point for mobile systems beyond 3G since the completion of the initial LTE and the Evolved Packet Core (EPC) specifications. 3GPP Release 10 and later are compliant with the most recent ITU-R specifications for IMT-Advanced "Systems beyond 3G." The standard currently enables high-mobility communication at speeds of up to 100 Mbps and low-mobility communication at speeds of up to 1 Gbps. The original mission of 3GPP was to develop Technical Specifications and Technical Reports for a 3G Mobile System based on evolved GSM CNs and the radio access technologies that they support (i.e., Universal Terrestrial Radio Access (UTRA) in both frequency division duplex (FDD) and time division duplex (TDD) modes). The scope was later expanded to encompass the upkeep and development of GSM Technical Specifications and Technical Reports, as well as advanced radio access technologies (e.g., GPRS and EDGE). All GSM (including GPRS and EDGE), W-CDMA, and LTE (including LTE-Advanced) specifications are included in the term "3GPP specification".
- **3GPP2 (Third-Generation Partnership Project 2):** 3GPP2 is a collaborative 3G telecommunications specification-setting project that includes North American and Asian interests in developing global specifications for ANSI/TIA/EIA-41 Cellular Radio telecommunication Intersystem Operations network evolution to 3G, as well as global specifications for the radio transmission technologies (RTTs) supported by ANSI/TIA/EIA-41. 3GPP2 encompasses HS, broadband, and Internet protocol (IP)-based mobile systems with network-to-network interconnection and feature/service transparency, global roaming, and location-independent services, thanks to the International Telecommunication Union's (ITU) International Mobile Telecommunications "IMT-2000" effort.
- **6LoWPAN: IPv6 over low-power area networks (IEEE 802.15.4):** 6LoWPAN Based on RFC 4944, 6LoWPAN is currently a generally acknowledged method for running IP on 802.15.4.TinyOS, Contiki, and protocols such as ISA100 and ZigBee SE 2.0 all support it. RFC 4944

disguises 802.15.4 as an IPv6 link. It provides simple encapsulation and efficient 100-byte packet representation. It covers themes such as:

- The first approach to stateless header compression
- Datagram tag/datagram offset
- Mesh forwarding
- Identify originator/final destination
- Minimal use of complex MAC layer concepts

- **ANT/ANT+:** Dynastream's sensor company created ANTTM, a low-power proprietary wireless technology, in 2004. The technology runs on the 2.4 GHz frequency band. ANT devices can run for years on a single coin cell. The purpose of ANT is to connect sports and fitness sensors to a display device. ANT+TM expands the ANT protocol and allows devices to communicate in a controlled network. As a prerequisite for adopting ANT+ branding, ANT+ recently launched a new certification process.
- **Bluetooth:** Bluetooth is a Personal Area Network (PAN) technology that is based on IEEE 802.15.1. It is a short-range wireless communication specification for portable personal devices that was created by Ericsson. The Bluetooth SIG made their specifications public in the late 1990s, at which point the IEEE 802.15 Group took over and established a vendor-independent standard based on the Bluetooth work. IEEE 802.15 sublayers include
  - RF layer
  - baseband layer
  - link manager
  - L2CAP
- Bluetooth has progressed through four iterations, with all Bluetooth standards remaining downwardly compatible. BLE is a subset of Bluetooth v4.0 that includes a completely new protocol stack for the speedy establishment of basic links.BLE is an alternative to the "power management" features introduced as part of the standard Bluetooth protocols in Bluetooth v1.0 to v3.0 (Bluetooth is a trademark of the Bluetooth Alliance, a commercial organisation that certifies the interoperability of specific devices designed to the respective IEEE standard).
- **EDGE (Enhanced Data Rates for Global Evolution):** GSMTM radio access technology has been improved to deliver faster bit rates for data applications, both circuit and packet-switched. EDGE is accomplished as an upgrade to the existing GSM PHY layer, rather than as a distinct, standalone specification, by updates to the existing layer 1 specifications. EDGE, in addition to improving data rates, is transparent to the service offerings at the upper levels, although it is an enabler for HS circuit-switched data (HSCSD) and upgraded GPRS (EGPRS). For example, GPRS can provide a data rate of 115 Kbps, while EDGE can raise this to 384 Kbps. This is comparable to the rate for early Wideband Code Division Multiple Access (W-CDMA)

implementations, prompting some parties to view EDGE as a 3G technology rather than a 2G (EDGE systems can meet the ITU's IMT-2000 specifications with a capability of 384 Kbps).EDGE is commonly seen as a link between the two generations: a sort of 2.5G.

- **LTE (Long Term Evolution):** LTE is a 3GPP initiative to transition UMTS technology to 4G. LTE can be considered as an architecture framework and a set of auxiliary mechanisms aimed at delivering smooth IP communication between UE and the packet (IPv4, IPv6) data network during mobility with no disruption to end-user applications. In contrast to previous-generation cellular networks' circuit-switched models, LTE is designed to offer solely packet-switched services.
- **NFC (Near Field Communication):** A set of standards for devices such as PDAs, cellphones, and tablets that enable the establishment of wireless communication when they are within a few inches of each other. These standards cover communications protocols as well as data interchange formats; they are based on existing RFID standards such as ISO/IEC 14443 and FeliCa (a contactless RFID smart card technology developed by Sony that is used in electronic money cards in Japan, for example). ISO/IEC 18092, as well as other standards defined by the NFC Forum, are examples of NFC standards. NFC standards enable two-way communication between endpoints (previous generation systems were exclusively one-way). Unpowered NFC-based tags can also be read by NFC devices, hence this technology can be used in place of prior one-way systems. NFC applications include contactless transactions.
- **Satellite systems:** Satellite communication is so important in commercial, TV/media, government, and military communications, because of their inherent multicast/broadcast capabilities, mobility features, and worldwide reach, dependability, and capacity to respond rapidly Open-space and/or adverse environment connectivity Satellite communications is a LOS one-way or two-way RF transmission. a transmission system made of a transmitting station (uplink) A satellite system that serves as a signal regenerator.