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Internal Assessment Test 1 – April 2024

Sub:	Introduction to Internet of Things (IoT)					Sub Code:	BETCK205H	Branch	ECE, CSE, ISE, AIML, AIDS
Date:	13/04/2024	Duration:	90 min's	Max Marks:	50	Sem/Sec:	1st (Physics Cycle)		OBE

	Answer any FIVE FULL Questions	Marks	CO	RBT
1	Classify network type based on physical topologies and discuss the pros and cons of the following network topologies: Star, Ring, Mesh, Bus.	5+5	CO1	L1
2	With the neat diagram, explain the network communication between two hosts following the OSI Model.	10	CO1	L2
3	Differentiate between a) OSI model and TCP model b) IoT and M2M	5+5	CO1	L2

P.T.O.

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Internal Assessment Test 1 – April 2024

Sub:	Introduction to Internet of Things (IoT)					Sub Code:	BETCK205H	Branch	ECE, CSE, ISE, AIML, AIDS
Date:	13/04/2024	Duration:	90 min's	Max Marks:	50	Sem/Sec:	1st (Chemistry Cycle)		OBE

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P.T.O.

4	Explain various networking components of IoT.	10	CO1	L1
5	What is IoT explain giving examples? Summarize the characteristic features of IoT systems.	5+5	CO1	L1
6	Explain the IoT planes with neat figure with respect to complex interdependencies of technologies.	10	CO1	L2
7	Discuss the Evolution of IoT with neat diagram.	10	CO1	L2

CI Signature *CCI Signature* *HOD Signature*

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Internal Assessment Test 1 – April 2024

Sub:	Internet of Things					Sub Code:	22ETC25H	Branch:	
Date:	13/4/2024	Duration:	90 min's	Max Marks:	50	Sem/Sec:	II All sections		OBE

	Answer any FIVE FULL Questions	MARKS	CO	RBT
1	**Classify network type based on physical topologies and discuss the pros and cons of the following network topologies: Star, Ring, Mesh, Bus.**	5+5	CO1	L1

Solution:

Depending on the physical manner in which communication paths between the hosts are connected, computer networks can have the following four broad topologies— **Star, Mesh, Bus, and Ring.**

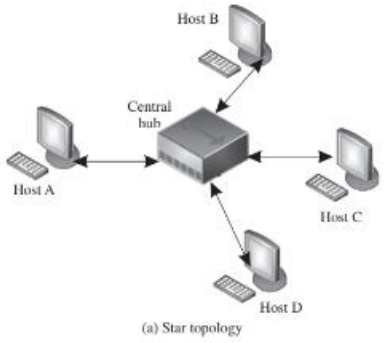
1. **Star:** In a star topology, every host has a point-to-point link to a central controller or hub. The hosts cannot communicate with one another directly; they can only do so through the central hub.

The hub acts as the network traffic exchange.

Advantages:

1. This topology is cheaper and easier to set up.
2. Ease of fault identification within the network.

The main **Disadvantage** of this topology is the danger of a single point of failure. If the hub fails, the whole network fails**.**



(a) Star topology

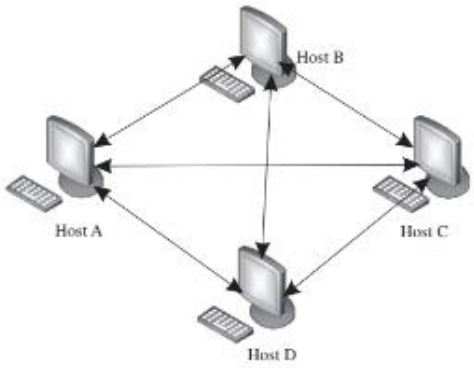
2. **Mesh:** In a mesh topology, every host is connected to every other host using a dedicated link (in a point-to-point manner).
This implies that for n hosts in a mesh, there are a total of **n(n−1)/2** dedicated full duplex links between the hosts.

Advantages:

- The massive number of links makes the mesh topology expensive.
- The robustness and resilience of the system. Even if a link is down or broken, the network is still fully functional as there remain other pathways for the traffic to flow through.
- The security and privacy of the traffic as the data is only seen by the intended recipients and not by all members of the network.
- The reduced data load on a single host, as every host in this network takes care of its traffic load.

Disadvantages:

- The complexities in forming physical connections between devices
- The cost of establishing the redundant links is high,



(b) Mesh topology

3. **Bus:** A bus topology follows the point-to-multipoint connection.

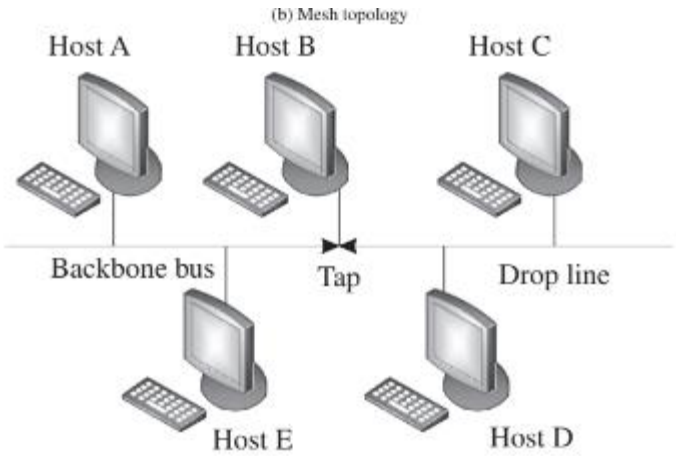
A backbone cable or bus serves as the primary traffic pathway between the hosts. The hosts are connected to the main bus employing drop lines or taps.

Advantages:

- Ease of installation**.**
- It has a simple cabling procedure in which a single bus (backbone cable) can be used for an organization.
- Multiple drop lines and taps can be used to connect various hosts to the bus, making installation very easy and cheap.

Disadvantages:

- There is a restriction on the length of the bus and the number of hosts that can be simultaneously connected to the bus due to signal loss over the extended bus.
- It is difficult to fault localization within the network.



4. **Ring:** A ring topology works on the principle of a point-to-point connection. Here, each host is configured to have a dedicated point-to-point connection with its two immediate neighboring hosts on either side of it through repeaters at each host.

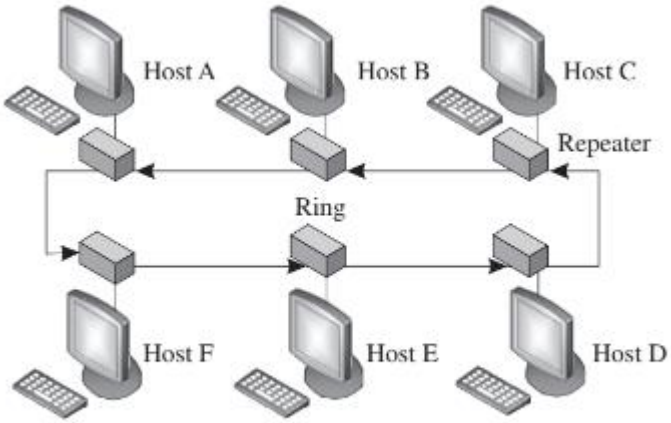
The repetition of this system forms a ring. The repeaters at each host capture the incoming signal intended for other hosts, regenerate the bit stream, and passes it onto the next repeater.

Advantages:

- Fault identification and set up of the ring topology is quite simple and straightforward.

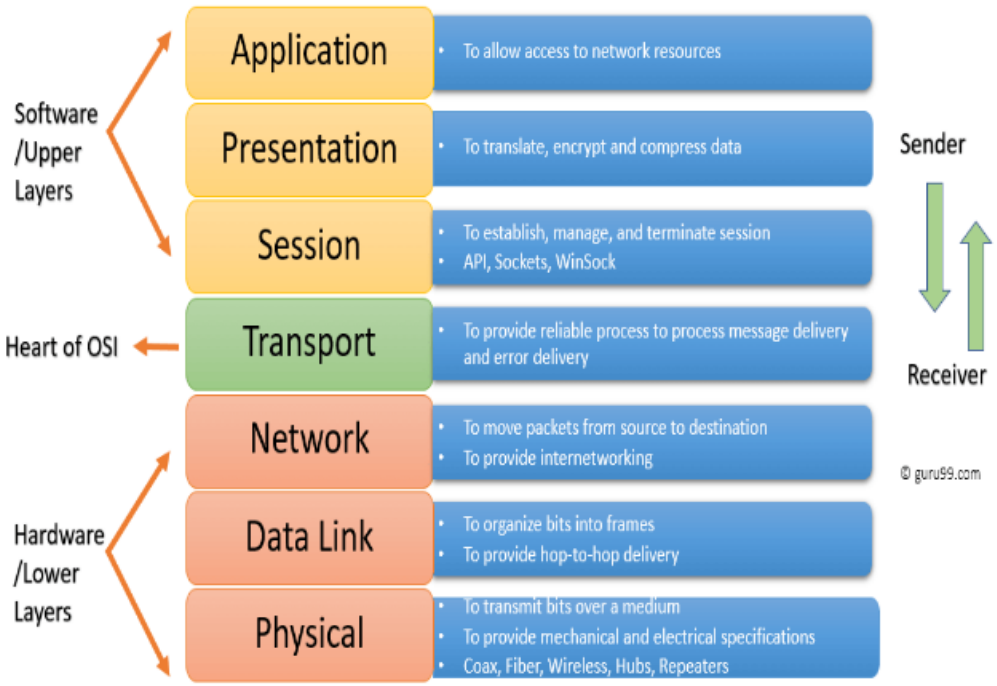
Disadvantages:

- High probability of a single point of failure**.**
- If even one repeater fails, the whole network goes down.



(c) Bus topology

2	**With the neat diagram, explain the network communication between two hosts following the OSI Model.** **Solution:** OSI Layered Network Models: · OSI stands for Open Systems Interconnection. · It has been developed by ISO – 'International Organization for Standardization', in the year 1984. · It is 7 layer architecture with each layer having specific functionality to perform.	10	CO1	L2



1. Physical Layer:

· It is responsible for the actual physical connection between the devices.

· The physical layer contains information in the form of bits.

· The functions of the physical layer are as follows:

Bit synchronization:

Bit rate control:

Physical topologies:

Transmission mode:

2. Data Link Layer (DLL) :

· The data link layer is responsible for the node-to-node delivery of the message.

· The main function of this layer is to make sure data transfer is error-free from one node to another, over the physical layer.

· Data Link Layer is divided into two sub layers: Logical Link Control (LLC) Media Access Control (MAC)

• The functions of the Data Link layer are :

Framing: Physical addressing:

Error control:

Flow Control:

Access control:

3. Network Layer:

· The network layer works for the transmission of data from one host to the other located in different networks.

· It also takes care of packet routing i.e. selection of the shortest path to transmit the packet, from the number of routes available.

· The sender & receiver's IP addresses are placed in the header by the network layer.

· The functions of the Network layer are : Routing: Logical Addressing:

4. Transport Layer:

· The transport layer provides services to the application layer and takes services from the network layer.

· The data in the transport layer is referred to as Segments.

· The transport layer also provides the acknowledgement of the successful data transmission and re-transmits the data if an error is found.

· At sender's side: Transport layer receives the formatted data from the upper layers, performs Segmentation, and also implements Flow & Error control to ensure proper data transmission.

· At receiver's side: Transport Layer reads the port number from its header and forwards the Data which it has received to the respective application. It also performs sequencing and reassembling of the segmented data.

· The functions of the transport layer are as follows:

Segmentation and Reassembly:

Service Point Addressing:

· The services provided by the transport layer : A. Connection-Oriented Service: It is a three-phase process that includes Connection Establishment Data Transfer Termination / disconnection

· In this type of transmission, the receiving device sends an acknowledgement, back to the source after a packet or group of packets is received. This type of transmission is reliable and secure.

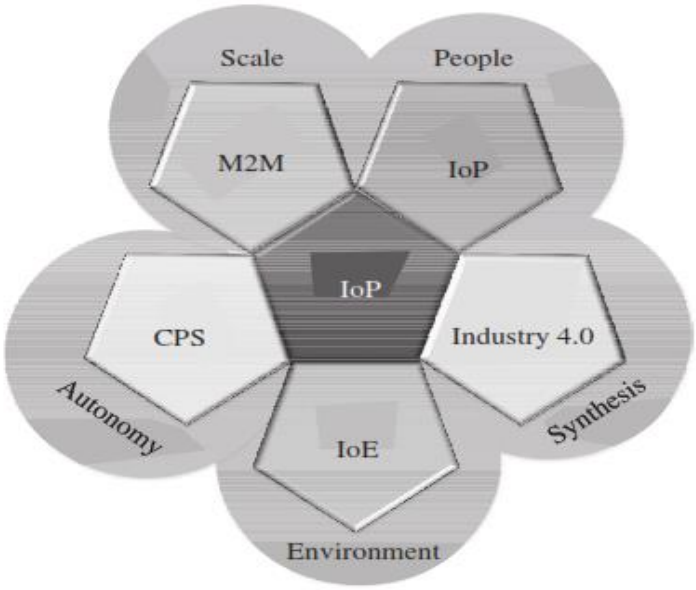
5. Session Layer:

· This layer is responsible for the establishment of connection, maintenance of sessions, authentication, and also ensures security.

· The functions of the session layer are : Session establishment, maintenance, and termination: Synchronization: Dialog Controller:

6. Presentation Layer:

· The data from the application layer is extracted here and manipulated as per the required format to transmit over the network.

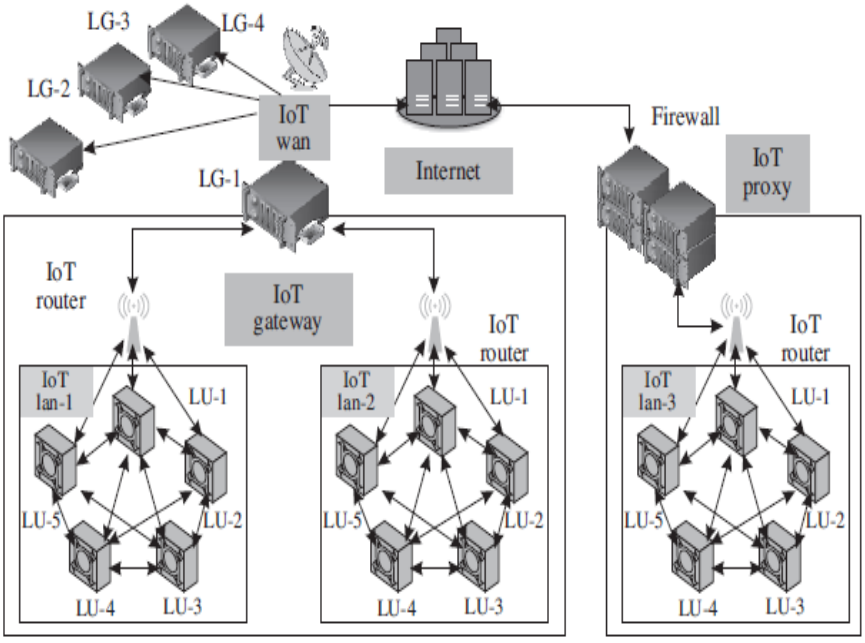
	· The functions of the presentation layer are : Translation: Encryption/ Decryption: Compression: **7. Application Layer:** · This layer serves as a window for the application services to access the network and for displaying the received information to the user. · The functions of the Application layer are : FTAM-File transfer access and management Mail Services Directory Services			
3	**Differentiate between a) OSI model and TCP model b) IoT and M2M** **Solution:**  ## IoT versus M2M M2M or the machine-to-machine paradigm refers to communications and interactions between various machines and devices. These interactions can be enabled through a cloud computing infrastructure, a server, or simply a local network hub. M2M collects data from machinery and sensors, while also enabling device management and device interaction. . M2M standards occupy a core place in the IoT landscape. However, in terms of operational and functional scope, IoT is vaster than M2M and comprises a broader range of interactions such as the interactions between devices/things, things, and people, things and applications, and people with applications; M2M enables the amalgamation of workflows comprising such interactions within IoT. Internet connectivity is central to the IoT theme but is not necessarily focused on the use of telecom networks.	5+5	CO1	L2

Parameters	OSI Model	TCP/IP Model
Full Form	OSI stands for Open Systems Interconnection.	TCP/IP stands for Transmission Control Protocol/Internet Protocol.
Layers	It has 7 layers.	It has 4 layers.
Usage	It is low in usage.	It is mostly used.
Approach	It is vertically approached.	It is horizontally approached.
Delivery	Delivery of the package is guaranteed in OSI Model.	Delivery of the package is not guaranteed in TCP/IP Model.
Replacement	Replacement of tools and changes can easily be done in this model.	Replacing the tools is not easy as it is in OSI Model.
Reliability	It is less reliable than TCP/IP Model.	It is more reliable than OSI Model.

4 **Explain various networking components of IoT.** 10 CO1 L1

Solution:

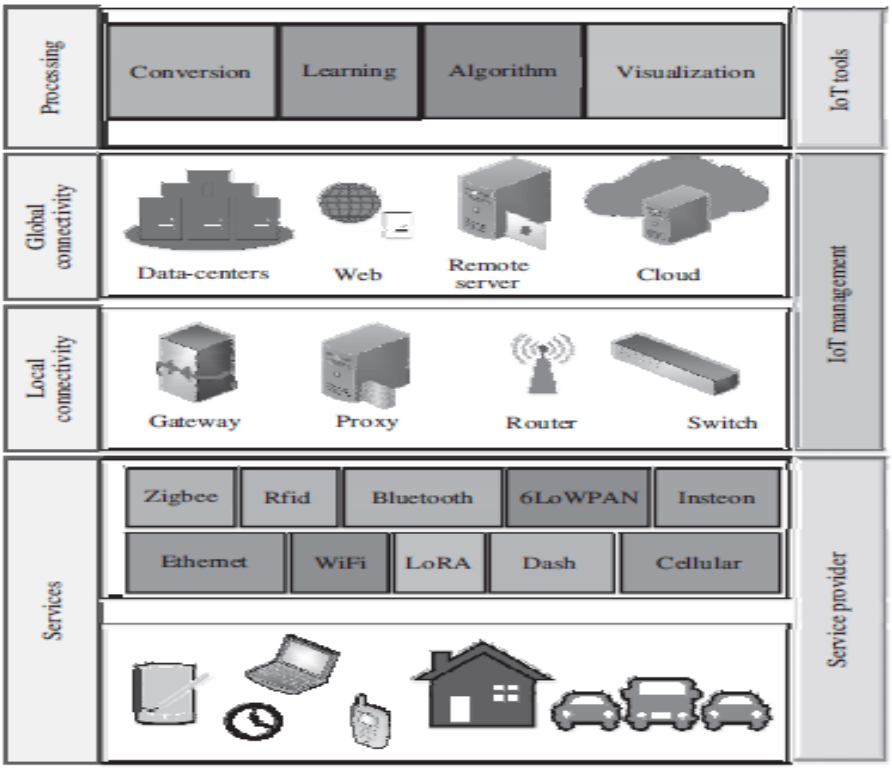
1) IoT node
2) IoT router
3) IoT LAN
4) IoT WAN
5) IoT gateway and
6) IoT proxy.



- **IoT Node:** These are the networking devices within an IoT LAN. Each of these devices is typically made up of a sensor, a processor, and a radio, which communicates with the network infrastructure.
- **IoT Router: An IoT router is a piece of networking equipment that is primarily** tasked with the routing of packets between various entities in the IoT network; it keeps the traffic flowing correctly within the network.
- A router can be repurposed as a gateway by enhancing its functionalities.

	• **IoT LAN:** The local area network (LAN) enables local connectivity within the purview of a single gateway. • **IoT WAN:** The wide area network (WAN) connects various network segments such as LANs. • They are typically organizationally and geographically wide, with their operational range lying between a few kilometers to hundreds of kilometers. • **IoT Gateway:** An IoT gateway is simply a router connecting the IoT LAN to a WAN or the Internet. • Their primary task is to forward packets between LANs and WANs. • **IoT Proxy:** Proxies actively lie on the application layer and performs application layer functions between IoT nodes and other entities.			
5	**What is IoT explain giving examples? Summarize the characteristic features of IoT systems.** **Solution.** • The modern-day advent of network-connected devices has given rise to the The original Internet intended for sending simple messages is now connected with all sorts of "Things". • These things can be legacy devices, modern-day computers, sensors, actuators, household appliances, toys, clothes, shoes, vehicles, cameras, and anything which may benefit a product by increasing its scientific value, accuracy, or even its cosmetic value. • IoT is an anytime, anywhere, and anything network of Internet-connected physical devices or systems capable of sensing an environment and affecting the sensed environment intelligently. • Typically, IoT systems can be characterized by the following features: • Associated architectures, which are also efficient and scalable. • No ambiguity in naming and addressing. • Massive number of constrained devices, sleeping nodes, mobile devices, and non-IP devices. • Intermittent and often unstable connectivity. • IoT is speculated to have achieved faster and higher technology acceptance as compared to electricity and telephony.  **Figure 4.2** The three characteristic features—anytime, anywhere, and anything—highlight the robustness and dynamic nature of IoT •	5+5	CO1	L1

	• The original Internet intended for sending simple messages is now connected with all sorts of "Things". • These things can be legacy devices, modern-day computers, sensors, actuators, household appliances, toys, clothes, shoes, vehicles, cameras, and anything which may benefit a product by increasing its scientific value, accuracy, or even its cosmetic value. • IoT is an anytime, anywhere, and anything network of Internet-connected physical devices or systems capable of sensing an environment and affecting the sensed environment intelligently.			
6	**Explain the IoT planes with neat figure with respect to complex interdependencies of technologies.** **Solution** The IoT paradigm is divided into four planes: • Services, • Local connectivity, • Global connectivity, and • Processing. The service plane is composed of two parts: 1) Things or devices and 2) low-power connectivity**.** • Typically, the services offered in this layer are a combination of things and low power connectivity. • For example, any IoT application requires the basic setup of sensing, followed by rudimentary processing (often), and a low-power, low-range network, which is mainly built upon the IEEE 802.15.4 protocol. • The things may be wearable's, computers, smart phones, household appliances, smart glasses. • The immediate low-power connectivity, which is responsible for connecting the things in local implementation, may be legacy protocols such as WiFi, Ethernet, or cellular.	10	CO1	L2



- The local connectivity is responsible for distributing Internet access to multiple local IoT deployments.
- This distribution may be on the basis of the physical placement of the things, on the basis of the application domains, or even on the basis of providers of services.
- Services such as address management, device management, security, sleep scheduling, and others fall within the scope of this plane.
- Global connectivity plays a significant role in enabling IoT in the real sense by allowing for worldwide implementations and connectivity between things, users, controllers, and applications.
- This plane also falls under the purview of IoT management as it decides how and when to store data, when to process it, when to forward it, and in which form to forward it.
- The final plane of processing can be considered as a top-up of the basic IoT networking framework.
- The continuous rise in the usefulness and penetration of IoT in various application areas such as industries, transportation, healthcare, and others is the result of this plane.
- The members in this plane may be termed as IoT tools, simply because they wring-out useful and human-readable information from all the raw data that flows from various IoT devices and deployments.

7	**Discuss the Evolution of IoT with neat diagram.** **Solution** • The IoT, as we see it today, is a result of a series of technological model shifts over a few decades. • The technologies that laid the foundation of connected systems by achieving easy integration to daily lives, popular public acceptance, and massive	10	CO1	L2

benefits by using connected solutions can be considered as the founding solutions for the development of IoT.

- Figure shows the sequence of technological advancements for shaping the IoT as it is today.

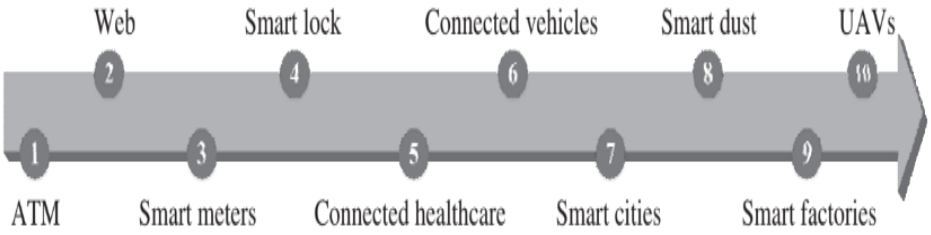


Figure 4.6 The sequence of technological developments leading to the shaping of the modern-day IoT

- The first ATM became operational and connected online for the first time in 1974.
- The Web became operational for the first time in 1991.
- The earliest smart meter was a power meter, which became operational in early 2000.
- The present-day IoT spans across various domains and applications.
- The major highlight of this paradigm is its ability to function as a cross-domain technology enabler.
- IoT is being used in vivid and diverse areas such as smart parking, smartphone detection, traffic congestion, smart lighting, waste management, smart roads, structural health, urban noise maps, river floods, water flow, silos stock calculation, water leakages, radiation levels, explosive and hazardous gases, perimeter access control etc..
- Figure 4.7 shows the various technological interdependencies of IoT with other domains and networking paradigms such as M2M, CPS, the Internet of environment (IoE), the Internet of people (IoP), and Industry 4.0.
- Each of these networking paradigms is a massive domain on its own, but the omnipresent nature of IoT implies that these domains act as subsets of IoT.