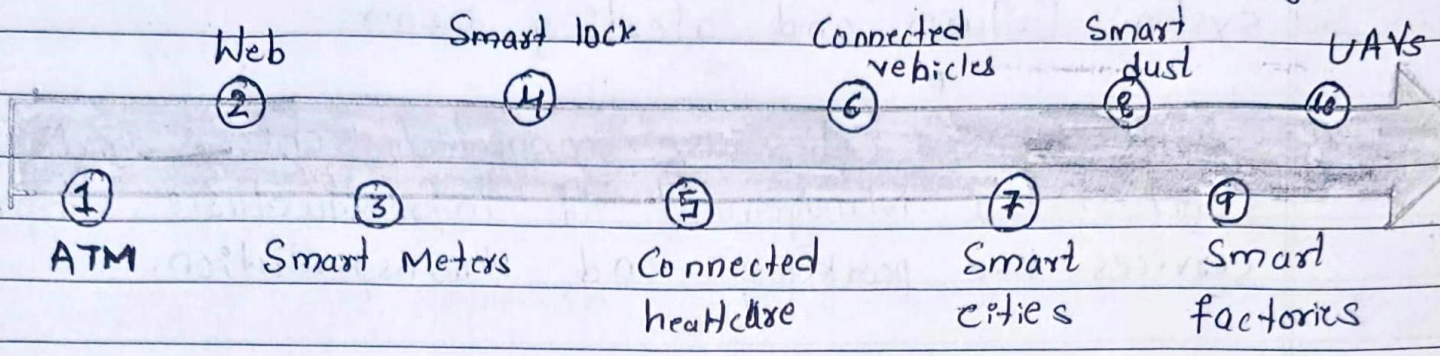
1) Explain the evolution of IOT with neat diagram

Soln



- ATM : Automated teller machines (ATMs) dispense cash by verifying user identity through a coded card. They allow financial transactions outside regular bank hours and became operational in 1974

- Web : The World Wide Web is a global communication platfor that started in 1991, driving many computing and communication revolutions

- Smart Meters : Introduced in the early 2000s, smart mete remotely communicate with power grids, enabling remote monitoring and billing

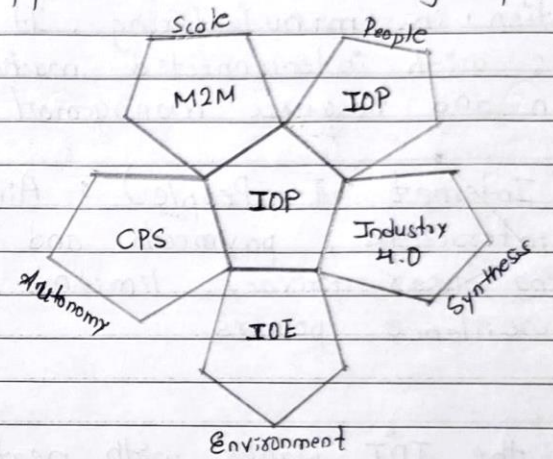
- Digital Locks : Modern digital locks can be controlled via smartphones, allowing remote locking, unlocking and managing access codes

- Connected healthcare : Devices connected patients to doctors and hospitals, offering faster access to medical records monitoring heart rates, and responding to emergencies.

- Connected Vehicles : Vehicles can communicate with the internet, other vehicles, or internal sensors, diagnosing system failures and alerting owners.
- Smart cities : Cities use connected sensors and system for synchronized management of infrastructure, improving services like parking and transportation.
- Smart Dust : Microscopic computers that can monitor environments, such as soil chemicals or diagnosing medical issues.
- Smart factories : These factories use automated systems to manage processes, reducing human error and optimizing production.
- UAVs : Unmanned aerial vehicles are used for agriculture surveys, surveillance, deliveries and more

2) Explain the interdependence and reach of IOT over various applies and networking paradigms with neat diagram

Ans



The interdependence and reach of IOT extends across multiple application domains and networking paradigms.

- M2M (Machine-to-machine) : Systems where communicate with each other without human intervention, exchaning update on status, tasks, and system knowledge
- CPS (Cyber-physical System) : closed-loop control system using sensing, processing and actuation. CPS automate operations, requiring minimal human supervision, ensuring environments are maintained through continous feedback
- IOE (Internet of Everything) : Focuses on reducing the environmental impact of internet-based technologies, with applications in sustainable farming

energy - efficient systems, and habitats

- Industry 4.0 : The fourth industrial revolution involving digitization in manufacturing. It promotes smart factories with interconnected machines for optimized production and resource management
- IOP (Internet of People) : Aims to decentralize online interactions, payments and tasks while protecting user privacy, limiting corporate, governmental and surveillance powers.

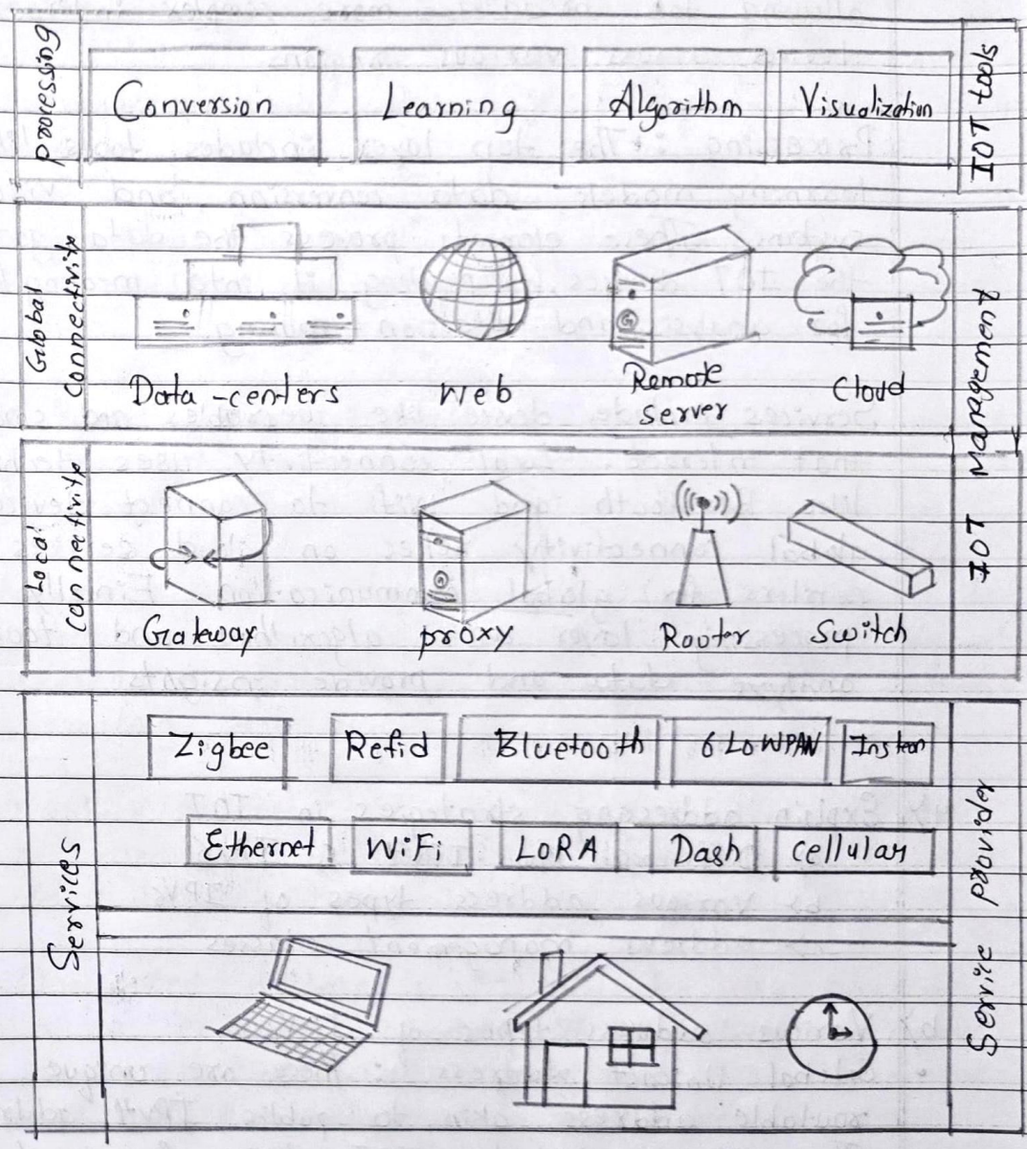
3) Explain the IOT planes with neat diagram

Ans

Services : At base, this plane includes various things like wearables, vehicles, homes, and smartphones that interact with each other. These devices rely on low-power connectivity to function and communicate

Local Connectivity : This layer includes technologies that enable short-range, low-power communication, such as Zigbee, Bluethooth, WiFi LoRa, and Ethernet. These help connect devices with in a localized area through routers, proxies, and gateways

Global Connectivity : This plane connects IOT systems globally using cloud services, remote servers, web access and data centers.



allowing for broader, more complex interactions between devices across various regions.

Processing : The top layer includes tools like algorithms learning models, data conversion, and visualization systems. These elements process the data gathered from the IOT devices, converting it into meaningful insights for analysis and decision-making.

Services include device like wearables and smart homes that interact. Local connectivity uses technologies like Bluetooth and Wifi to connect devices, while global connectivity relies on cloud services and data centers for global communication. Finally the processing layer uses algorithms and tools to analyze data and provide insights.

4) Explain addressing strategies in IOT
   a) Difference b/w IPv4 & IPv6
   b) Various address types of IPV6
   c) address management classes

b) Various address types of IPV6

- Global Unicast Address : These are unique, globally routable address, akin to public IPv4 address. They are assigned to IOT devices for direct communication over the global internet.
- Link-Local Address : These address are used for communication within a single network segment. They are automatically configured without the need for a DHCP server
- Unique local Address : These are similar to private IPv4 address and are used for local communication within a specific organisation or network.
- Multicast Address : Multicast allows a single packet to be sent to multiple devices simultaneously, instead of sending individual packets to each device
- Anycast Address : Anycast allows multiple devices to share the same address. Data sent to an anycast address is delivered to the nearest device in terms of routing distance
- Loopback Address : The loopback address (::1) is used by a device to send packets to itself for diagnostic and testing purpose
- Unspecified Address : :: indicates the absence of a a specific address. This address is used during initialization when an IOT device has not yet been assigned an address
- Solicited-Node Multicast :- It is a multicast address based on the IPv6 address of an IOT node or entity

a)

Feature	IPv4	IPv6
Address Size	32-bit (4.3 billion addresses)	128-bit (340 undecillion addresses)
Address Notation	Dotted decimal eg: 192.168.1.1	Hexadecimal Eg: 2001:0db8:7334
Security	Optional	Madatory
Header Complexity	Simple, but lacks efficiency	More complex, but more efficient
NAT Support	Requires NAT due to limited address	No NAT required
IOT Application	Limited address space for IOT	Support scalability for IOT.

c) Address Management Classes in IOT

Class 1 : Isolated Nodes (LLA)
Devices that only communicate within a small, isolated network using Link Local Addresses

class 2 : LANs with Gateway
Local networks where multiple IOT devices are interconneted and communicate through a gateway to the internet, These devices use ULA for local communication and GUA for external communication

class 3 : LAN with Proxy for Address Management
Similar to class 2 but with a proxy server that manages address allocation, ensuring that devices use appropriate ULA or GUA based on their communic-ation needs

class 4 : Gateway with Global Unicast Address (GUA)
A gateway provides IOT devices with globally unique IPv6 addresses allowing direct communication with the internet

class 5 : A central gateway manages all communication between IOT devices and the internet. All devices communicate with the gateway which assigns addresses as needed

class 6 : IOT devices have direct point-to-point communication with an internet gateway using globally unique addresses

class 7 : Multihoming
A more advanced setup where multiple gateways manage large numbers of IOT devices allowing for redudacy and load balancing.