Internet of Things

RTU EXAM **2021**

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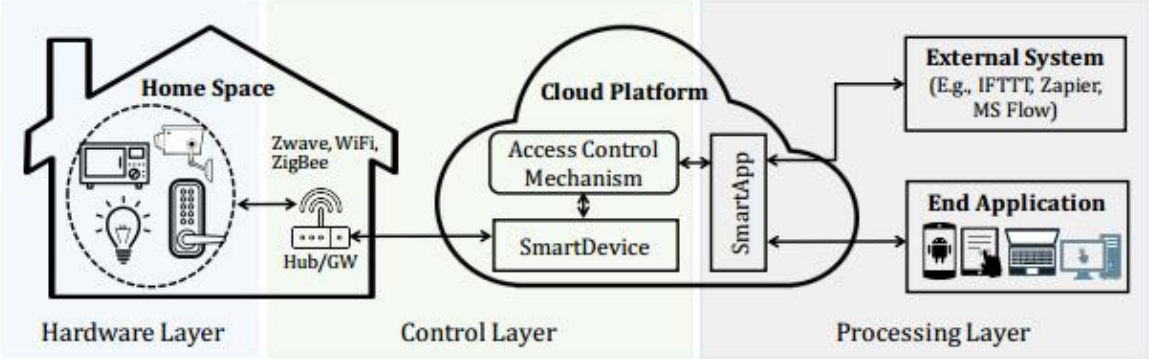
AITS Udaipur (Raj), Syllabus of RTU Kota

Note: Theory – All definition is Written in simple words,
So that you can write in Exams properly
Picture – We have taken all the simple pictures,
So that there is no problem at the time of Exam
Short Note - For Understand, Long Note – for Exam

Content

Case study of IoT Applications

Domain specific Home Automation:



i. Smart Lighting ii. Smart Appliances
iii. Intrusion Detection iv. Smoke / Gas Detectors

1. Home Automation:

i. **Smart Lighting** :- Smart lighting achieve energy savings by sensing the human movements and their environments and controlling the lights accordingly.

- ✓ Key enabling technologies for smart lighting include :
  - Solid state lighting (such as LED lights)
  - IP-enabled lights (Internet Protocol) **Mobile or Web Wireless Control**

ii. **Smart Appliances** (apps) :- Smart appliances make the management easier and provide status information of appliances to the users remotely. E.g: smart washer/dryer that can be controlled remotely and notify when the washing/drying cycle is complete.

- ✓ It comprises of three components:

  - a Controller :- manages scheduling and runtime integration between devices.

  - a Designer :-allows to create both configuration for the controller and user interface designs.
  - Control Panel :- allows to interact with devices and control them.

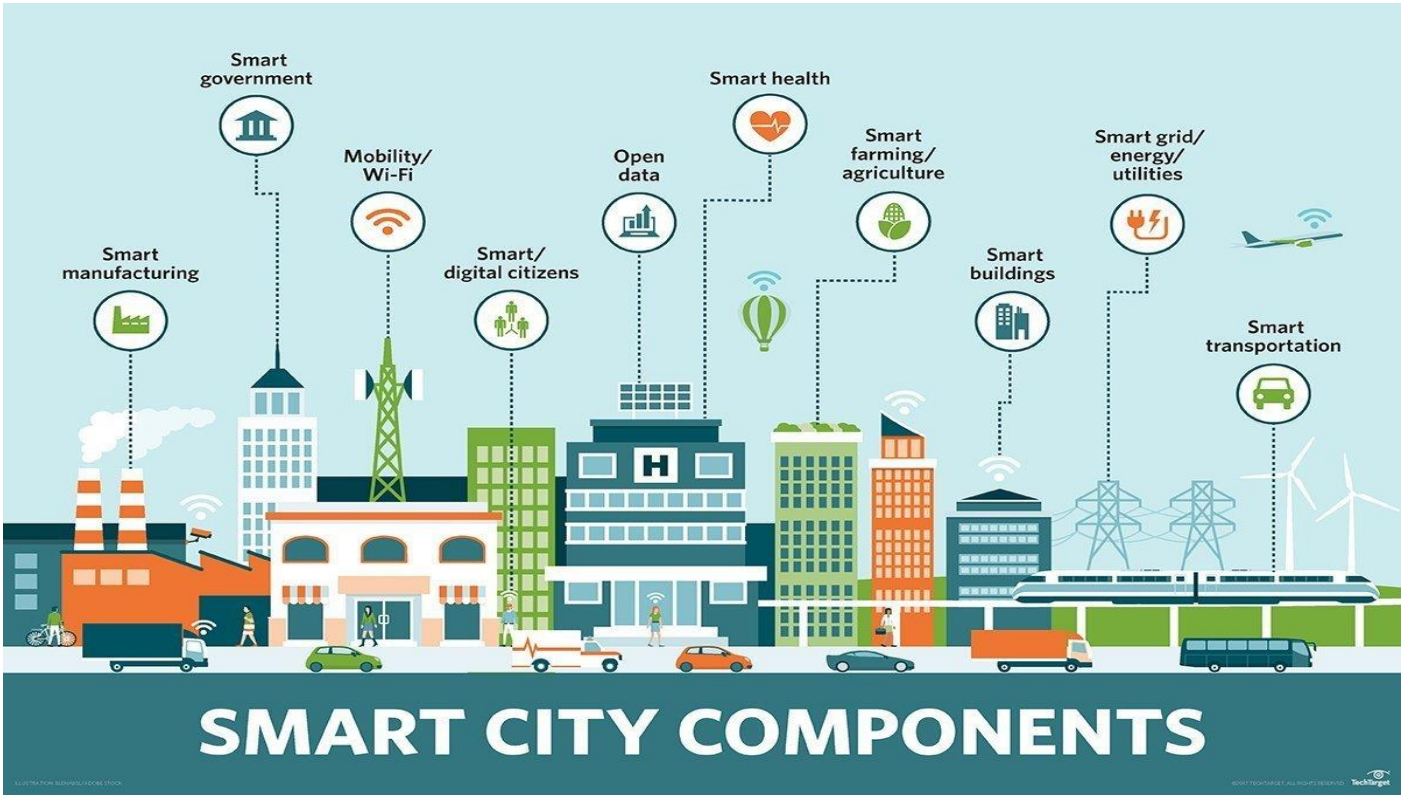
iii. Intrusion Detection (sensors) :- Home intrusion detection systems use security cameras and sensors to detect intrusions and raise alerts.

- ✓ The form of the alerts can be in form:
  - SMS
  - Email
  - Image grab or a short video clip as an email attachment

iv. Smoke / Gas Detectors :- Smoke detectors are installed in homes and buildings to detect smoke that is typically an early sign of fire.

- ✓ It uses optical detection, ionization or air sampling techniques to detect smoke
- ✓ The form of the alert can be in form :
  - Signals that send to a fire alarm system
  - Gas detector can detect the presence of harmful gases such as carbon monoxide (CO), liquid petroleum gas (LPG), etc.

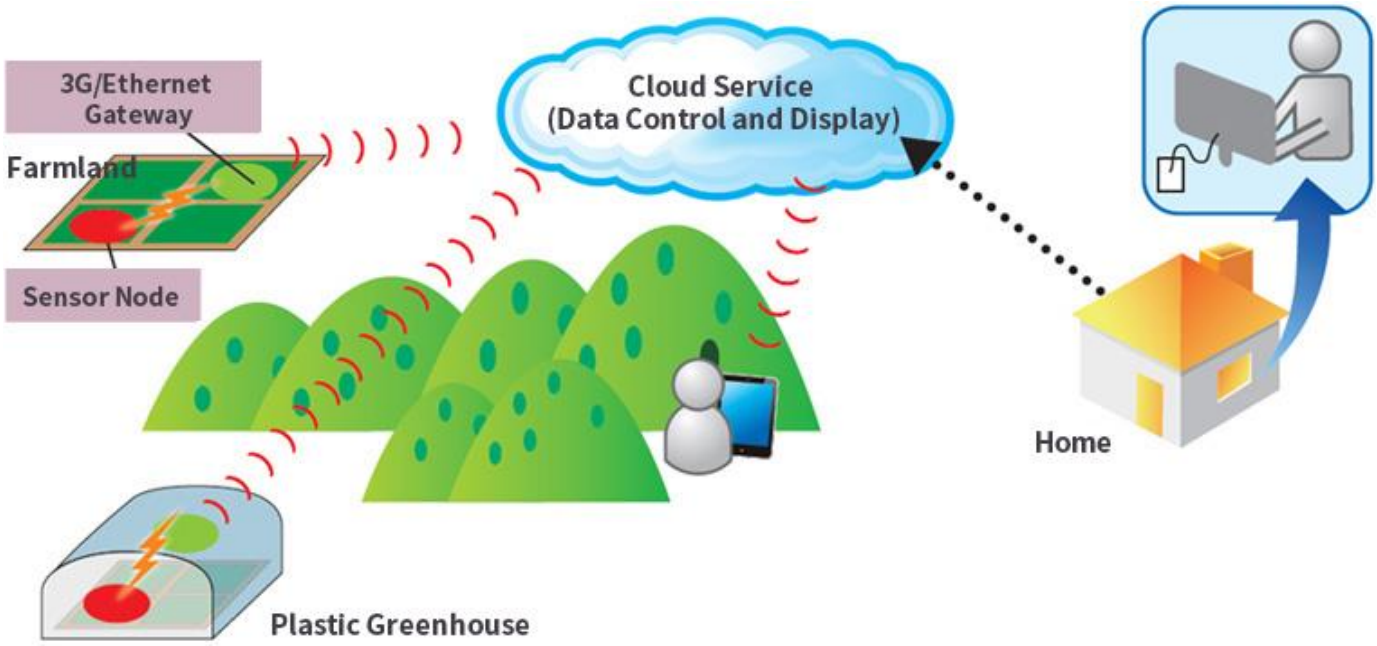
2. Cities :-



i. Smart Parking ii. Smart Lighting for Road iii. Smart Road
iv. Structural Health Monitoring v. Surveillance vi. Emergency

Note :- You are already genius, So You Better Understand for Smart City

3. Environment



i. Weather Monitoring	ii. Air Pollution Monitoring
iii. Noise Pollution Monitoring	iv. Forest Fire Detection

i. <u>Weather Monitoring</u> :- • It collects data from a number of sensor attached such as temperature, humidity, pressure, etc and send the data to cloud-based applications and store back-ends.

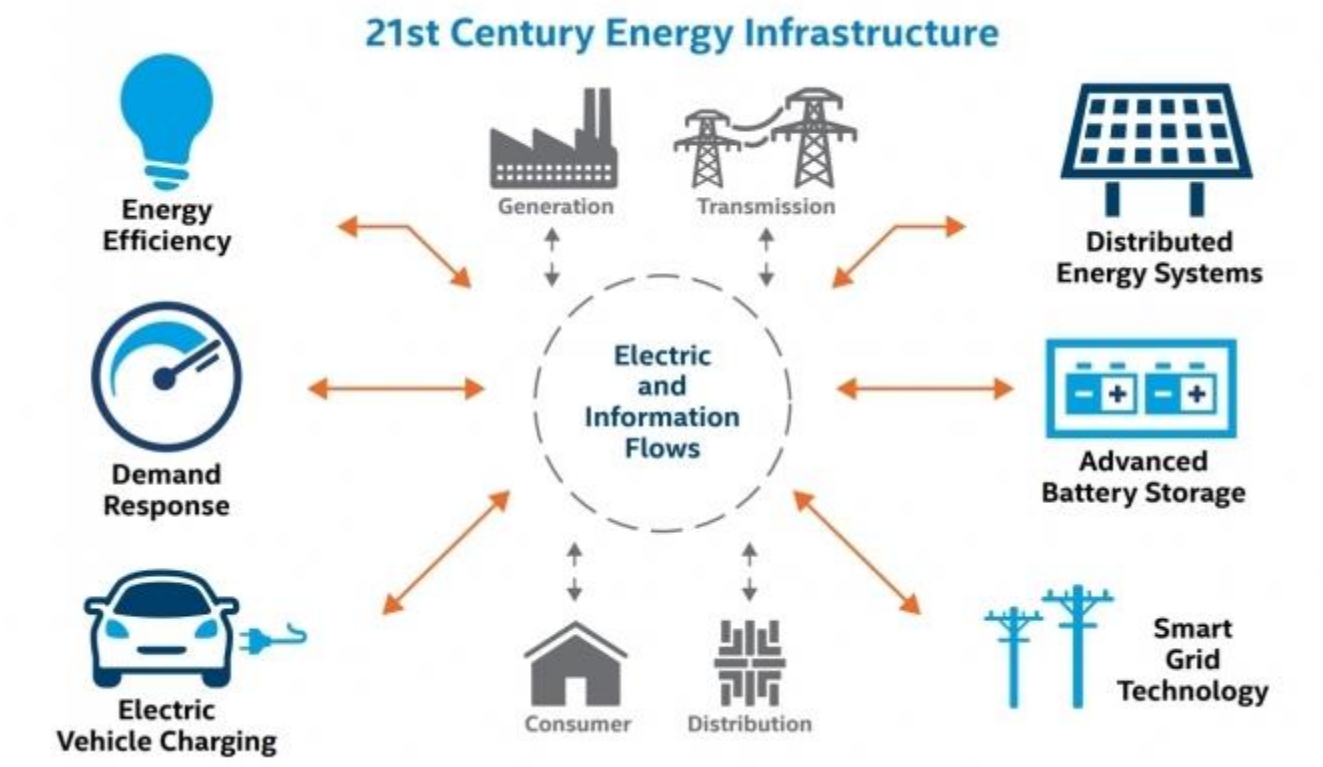
• The data collected in the cloud can then be analyzed and visualized by cloud-based applications.

• Weather alert can be sent to the subscribed users from such applications.

• AirPi is a weather and air quality monitoring kit capable of recording and uploading information, about temperature, humidity, air pressure, light levels, UV levels, carbon monoxide, nitrogen dioxide
and smoke level to the Internet.

Note :- River Flood Detection using (Ultrasonic Sensors)

4. Energy Systems



i. Smart Grid	ii. Renewable Energy Systems	iii. Prognostics

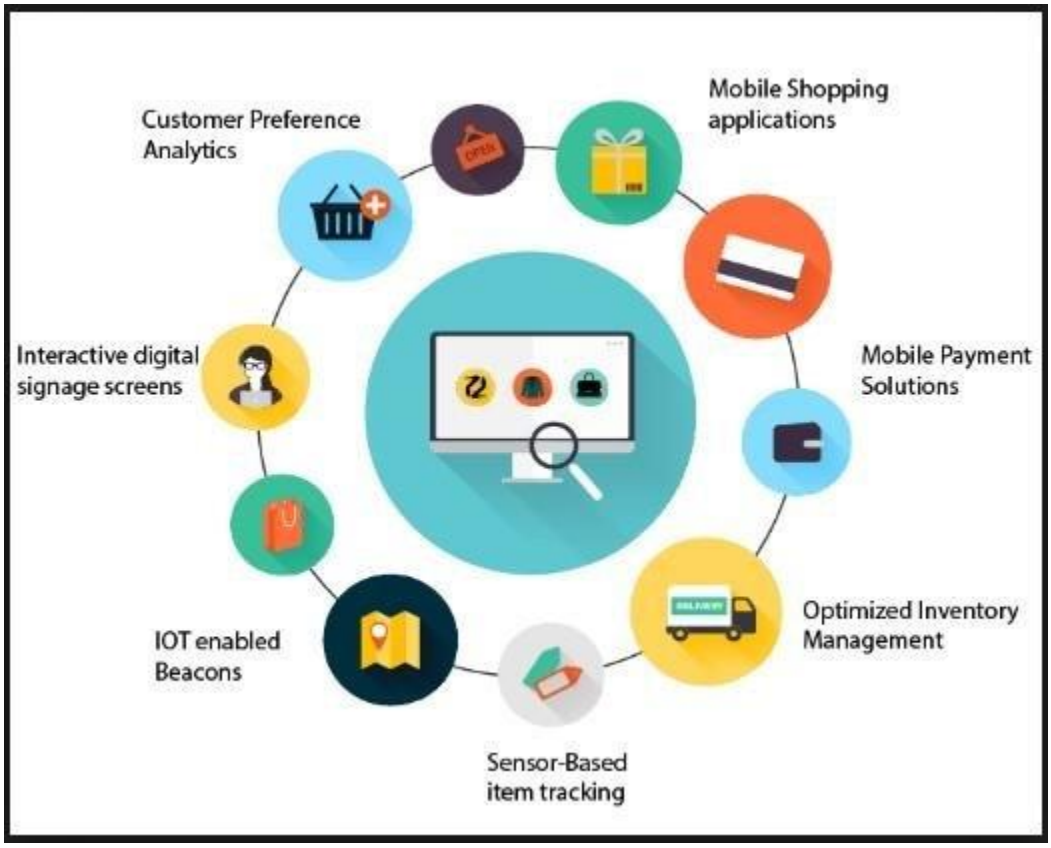
i. <u>Smart Grid</u> :- Smart grid technology provides predictive information and recommendation s to utilize, their suppliers, and their customers on how best to manage power.

- ✓ Smart grid collect the data regarding :
  - Electricity generation
  - Electricity consumption
  - Storage
  - Distribution and equipment health data

ii. <u>Renewable Energy System</u> :- Due to the variability in the output from renewable energy sources (such as solar and wind), integrating them into the grid can cause grid stability and reliability problems.

iii. <u>Prognostic</u> :- IoT based prognostic real-time health management systems can predict performance of machines of energy systems, real time information is collected using electrical sensors called Phasor Measurement Units (PMU)

5. Retail :



i. Inventory Management ii. Smart Payments iii. Smart Vending Machines

i. Inventory Management :- **inventory**—both raw materials (components) and finished goods (products) {That means Starting to Ending}.

> **inventory management** means the right stock, at the right levels, in the right place, at the right time, and at the right cost as well as price.

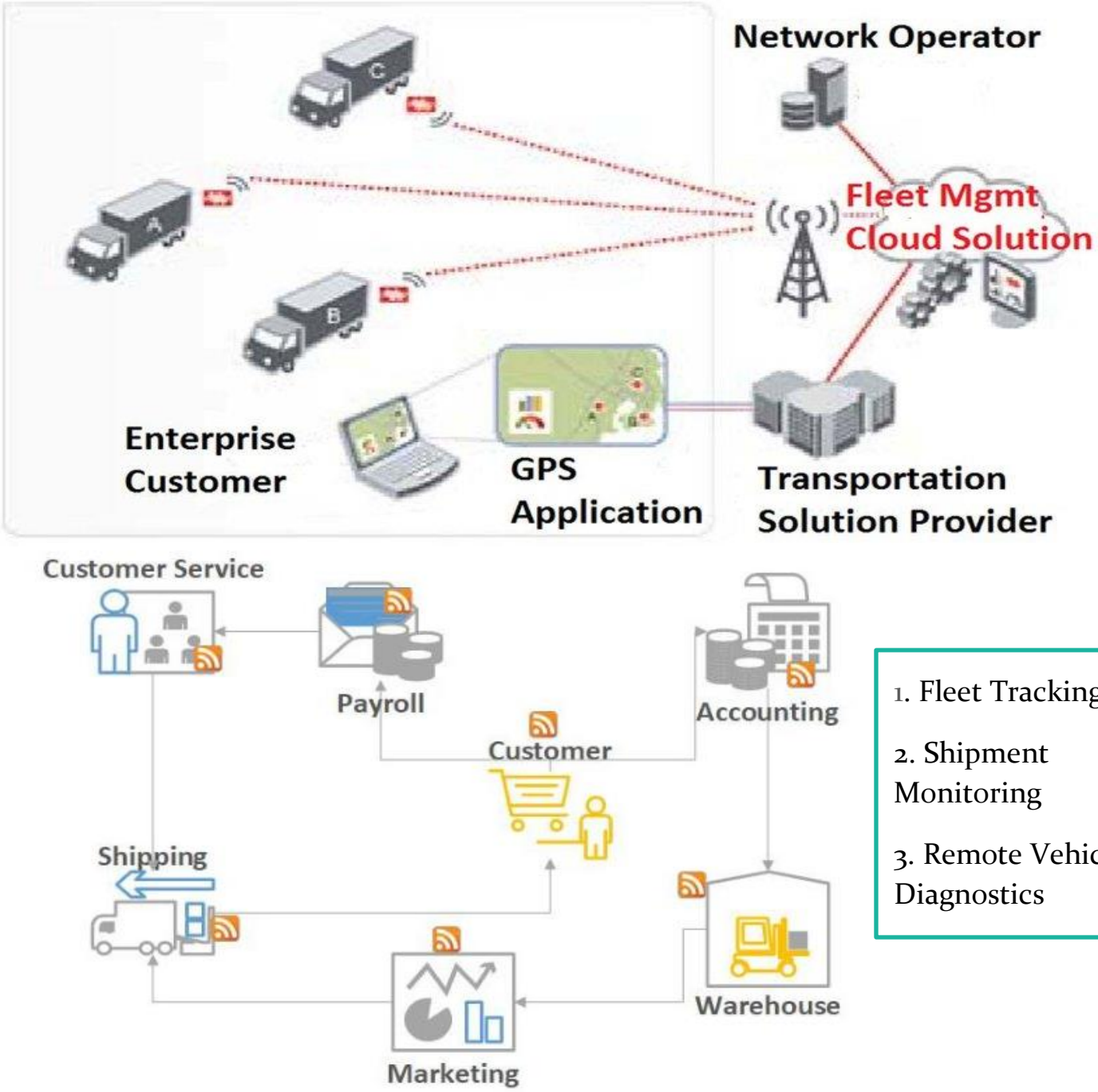
ii. Smart Payments :- Smart payments solutions such as contact-less payments powered technologies such as Near field communication (NFC) and Bluetooth.

> NFC is a set of standards for smart-phones and other devices to communicate with each other by without touching them

iii. Smart Vending Machines :- - Smart vending machines connected to the Internet allow remote monitoring of inventory levels, elastic pricing of products, promotions, and contact-less payments using NFC.

i.e :- so if a product out of stock in a machine, the user can be routed to nearest machine

6. Logistics :



1. Fleet Tracking
2. Shipment Monitoring
3. Remote Vehicle Diagnostics

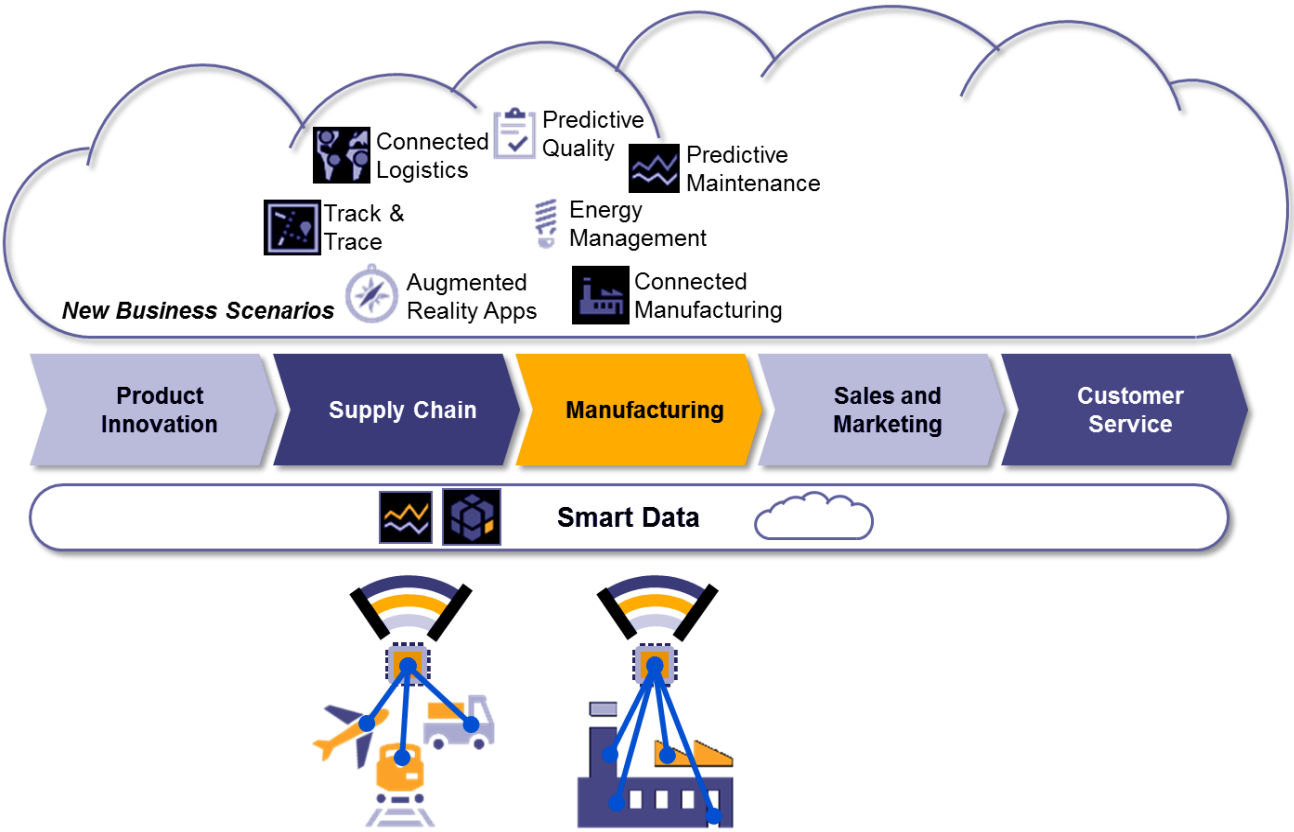
i. <u>Fleet Tracking</u> :- Vehicle fleet tracking systems use GPS technology to track the locations of the vehicles in the realtime.

- Cloud-based fleet tracking systems can be scaled up on demand to handle large number of vehicles

iii. <u>Remote Vehicale Diagnostic</u> :- vehicle operation such as speed, engine RPM, coolent temperature, fault code number and status of various vehicle subsystem.

OBD (on-board diagnostic) systems provide real-time data on the status of vehicle sub-systems and diagnostic trouble codes which allow rapidly identifying the faults in the vehicle.

7. Industry :



i. Machine Diagnosis & Prognosis ii. Indoor Air Quality Monitoring

i. <u>Machine Diagnosis & Prognosis</u> :- Machine prognosis refers to predicting the performance of machine by analyzing the data on the,

- Machine diagnosis refers to determining the cause of a machine fault.
- Sensors in machine can monitor the operating conditions such as temperature and vibration levels,

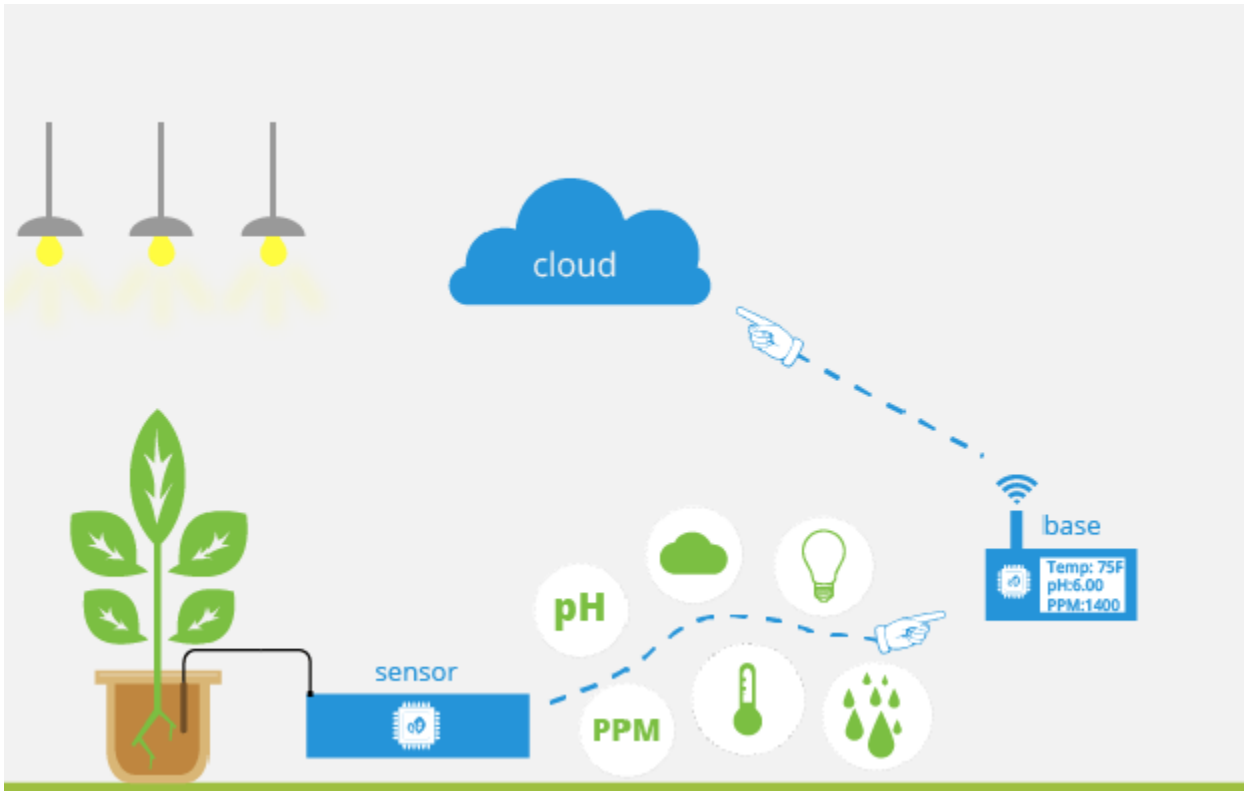
-Sensor data measurements are done on timescales of few milliseconds to few seconds which leads to generation of massive amount of data

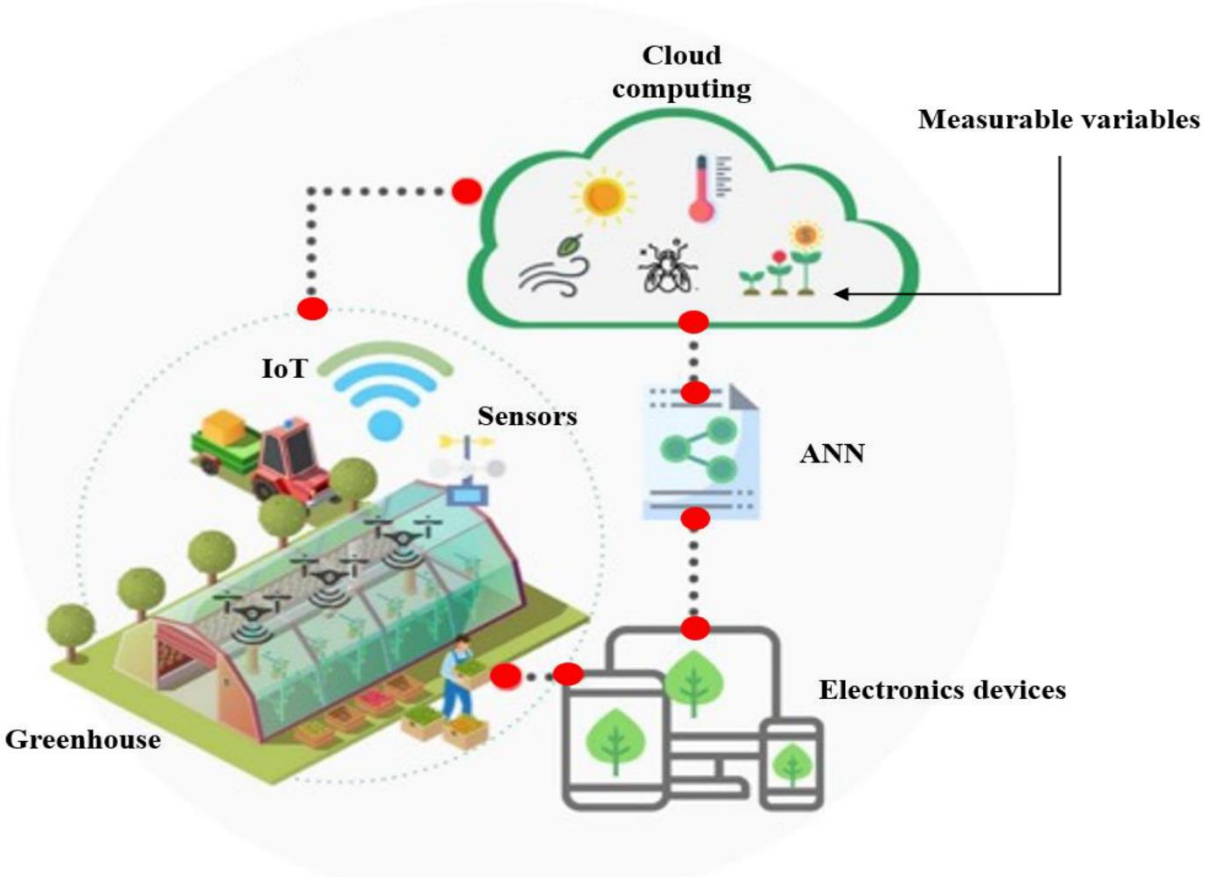
ii. <u>Indoor Air Quality Monitoring</u> :- Harmful and toxic gases such as carbon monoxide (CO), nitrogen monoxide (NO), Nitrogen Dioxide, etc can cause serious health problem of the workers.

- IoT based gas monitoring systems can help in monitoring the indoor air quality using various gas sensors.

- The indoor air quality can be placed for different locations

8. Agriculture :





1. Smart Irrigation 2. Green House Control

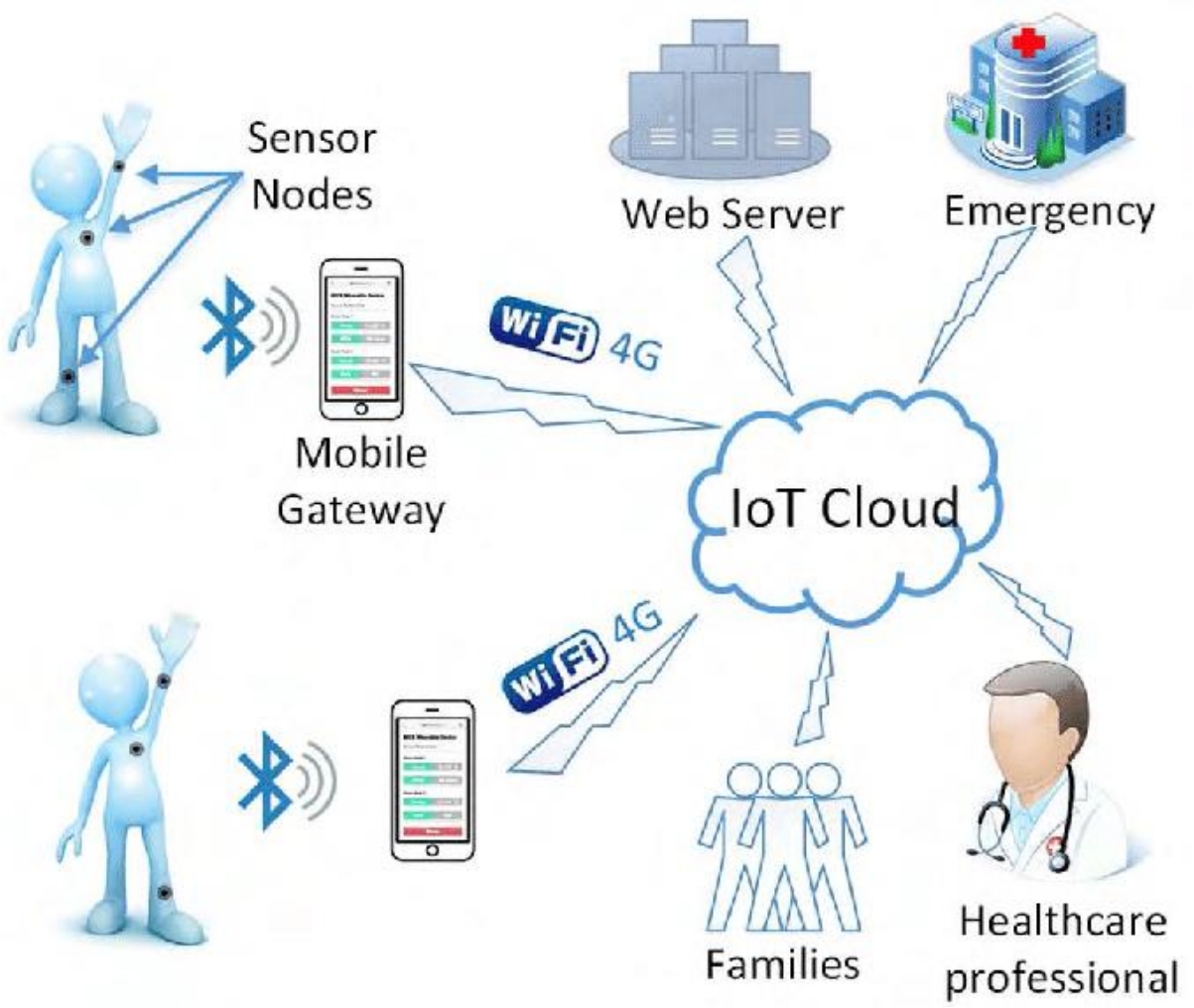
i. Smart irrigation :- Technology uses weather data or soil moisture (नमी) data to determine the **irrigation** need of the landscape.(जमीन)

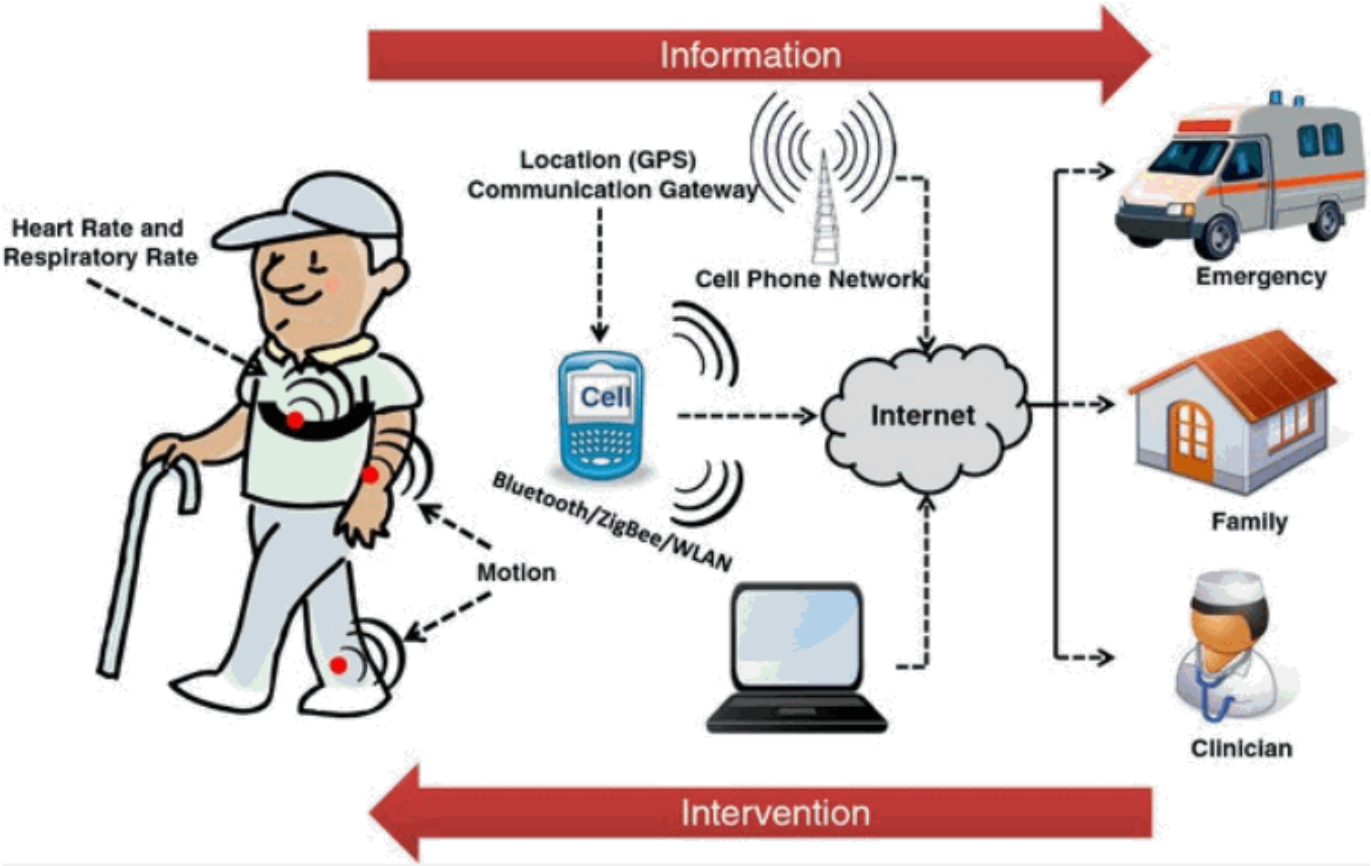
Smart irrigation technology includes: These products maximize **irrigation** efficiency by reducing water waste, while maintaining plant health and quality.

ii. Green House Control :- It controls temperature, humidity, soil, moisture, light, and carbon dioxide level that are monitored by sensors and climatological (जलवायु संबंधी) conditions that are controlled automatically using actuation devices.

- IoT systems play an importance role in green house control and help in improving productivity.

9. Health & Lifestyle :





IoT in Remote Health Monitoring

i. Health & Fitness Monitoring	ii. Wearable Electronics

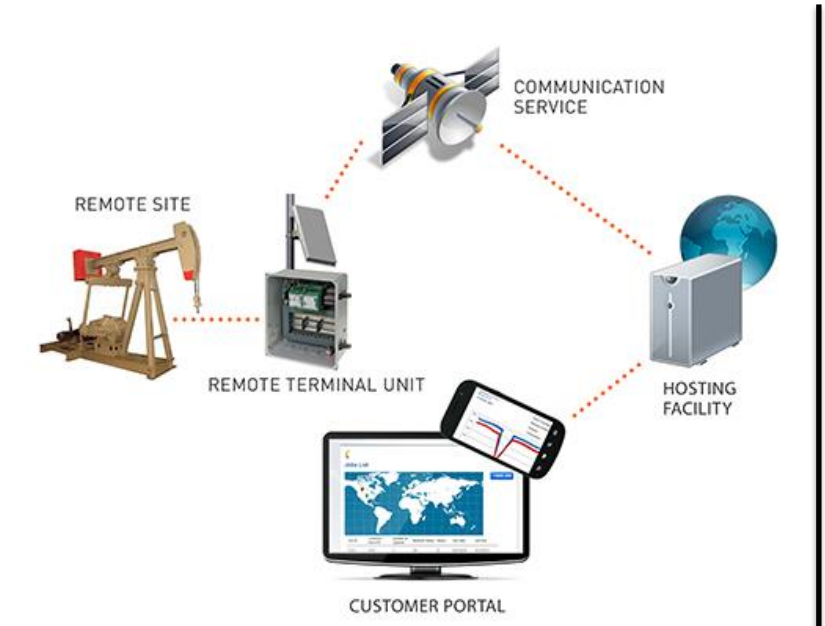
i. <u>Health & Fitness Monitoring</u> : - Wearable (पहनने लायक) IoT devices allow to continuous monitoring of physiological parameters such as blood pressure, heart rate, body temperature, etc than can help in continuous health and fitness monitoring.

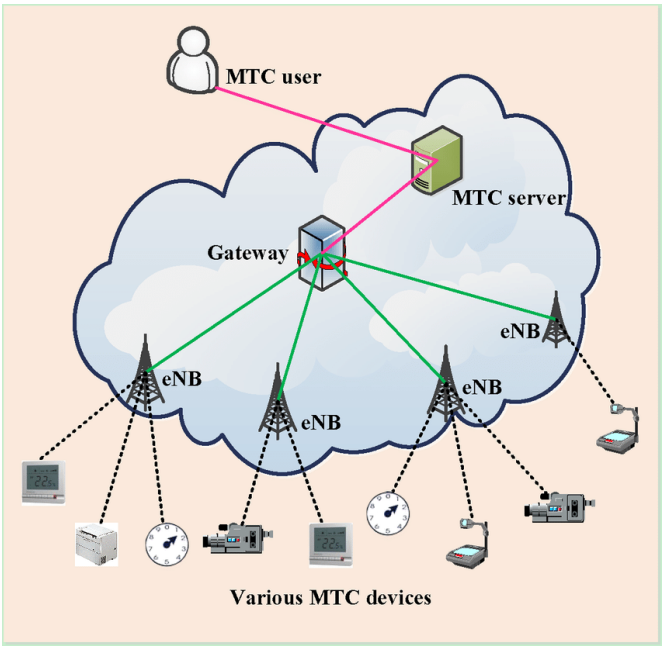
- It can analyze the collected health-care data to determine any health conditions or anomalies.
- The wearable devices may can be in various form such as:
  - ✓ Belts
  - ✓ Wrist-bands

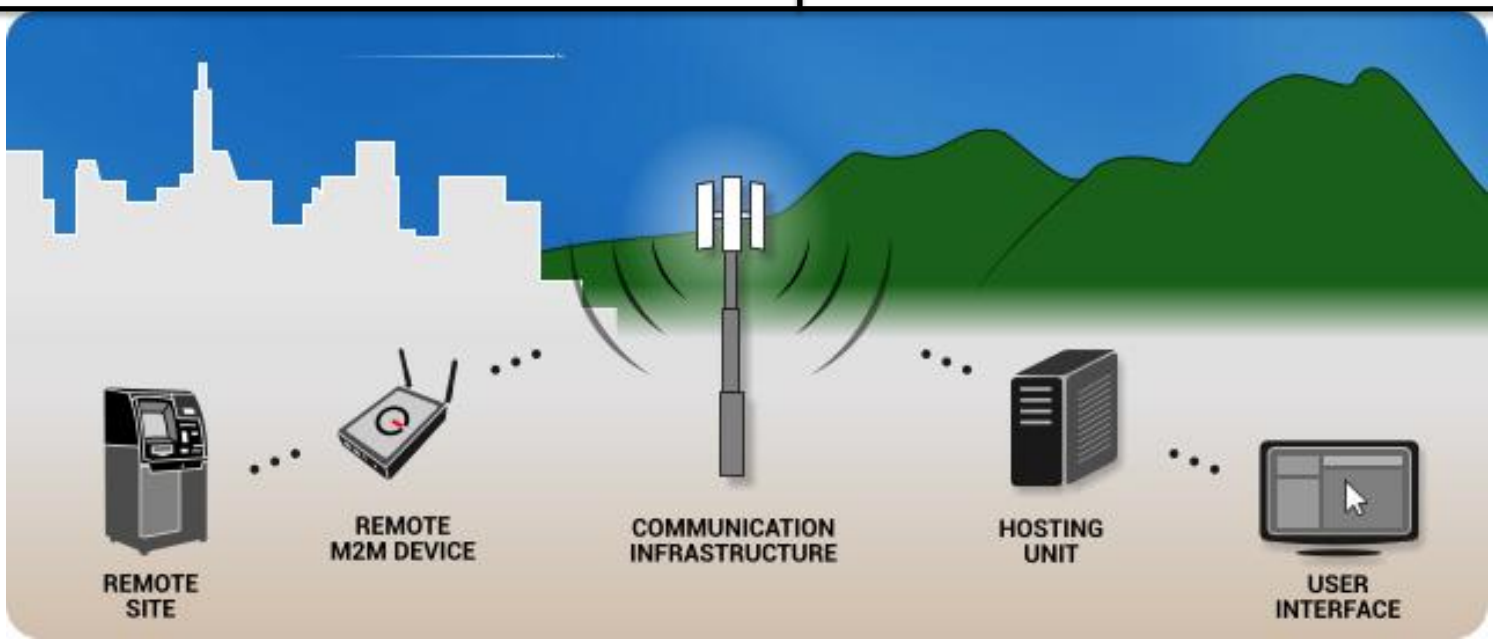
IOT and M2M

M2M : Machine to machine (M2M) is direct communication (point-to-point) between devices using any communications channel, including wired and wireless.

Machine to machine communication can include industrial instrumentation, enabling a sensor or meter to communicate the information it records to application software that can use it. You show that fig no. 1, 2, 3

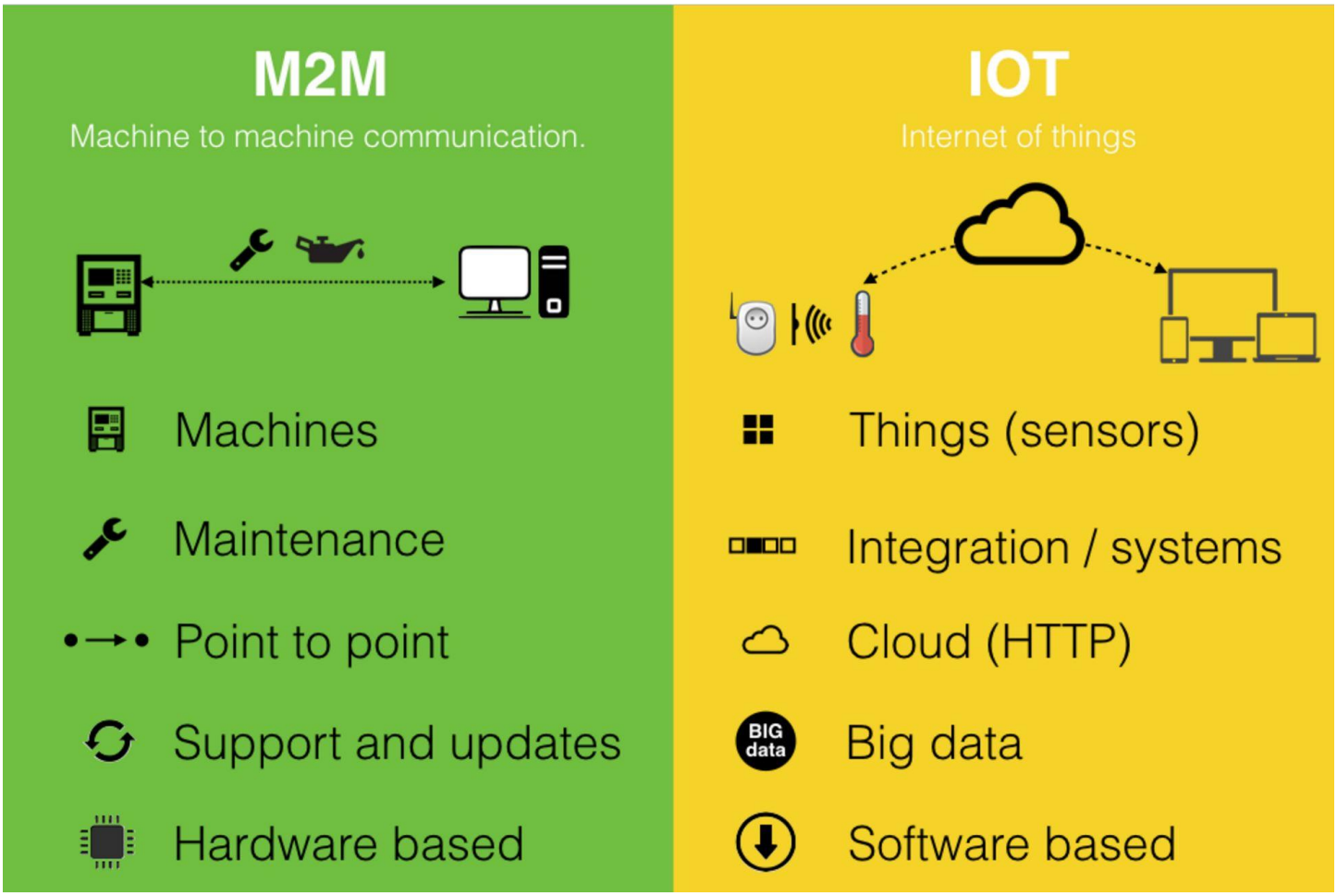






(Second Definition):- Machine-to-Machine (M2M) refers (Transfer) to networking of ma chines (or devices) for the purpose of remote monitoring and control and data exchange.

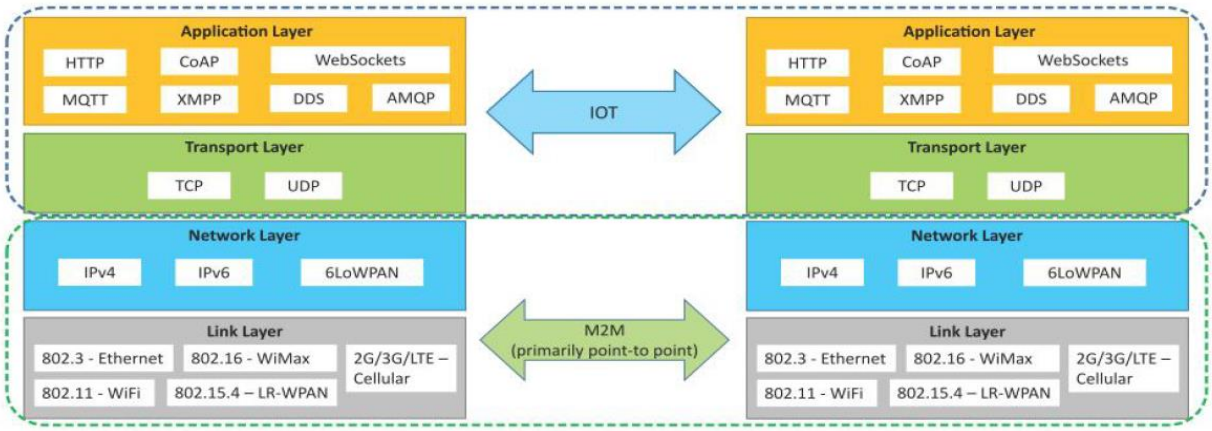
Iot and M2M :- This is sort summary of M2M and IOT different



Machines in M2M vs Things in IoT :

• The "Things" in IoT refers to physical objects that have unique identifiers and can sense and communicate with their external environment (and user applications) or their internal physical states.

• M2M systems, in contrast to IoT, typically have homogeneous machine types within an M2M area network.

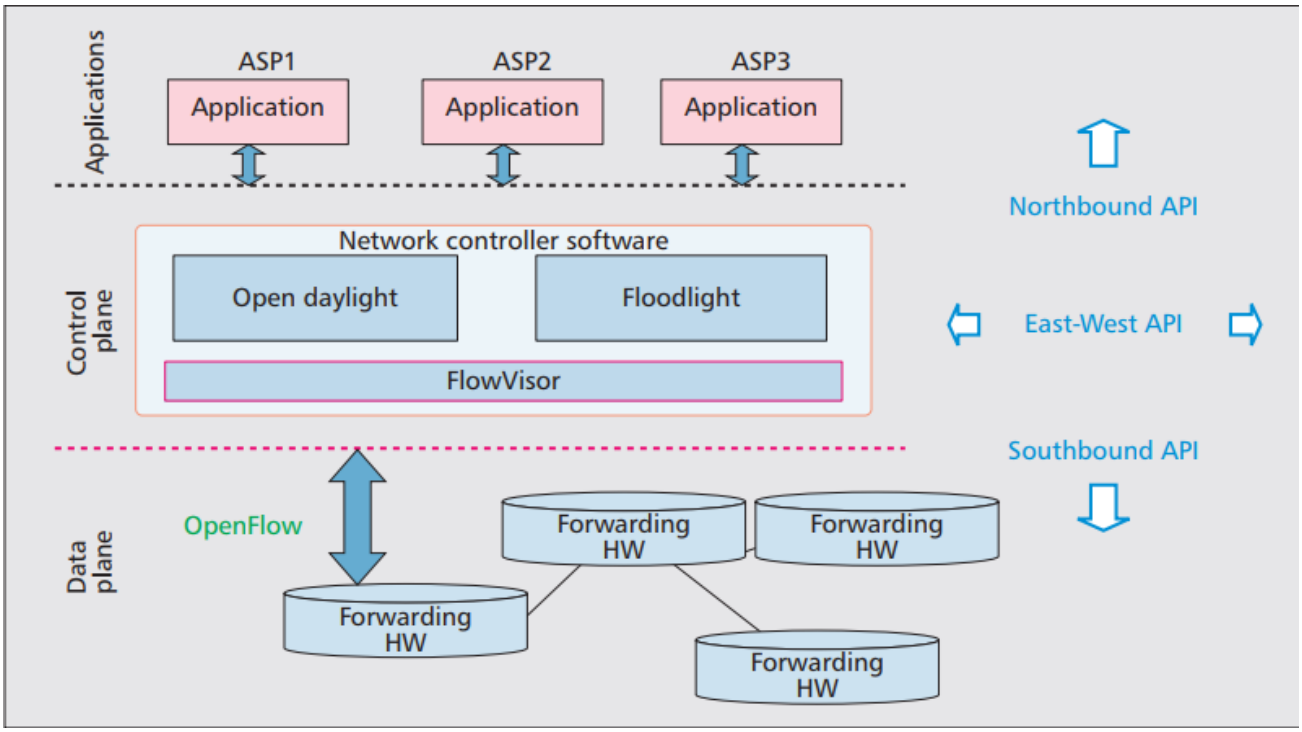


Difference between IoT and M2M (Long summary for Exam purpose) :

Basis of	Internet of Things	Machine to Machine
Intelligence	Devices have objects that are responsible for decision making	Some degree of intelligence is observed in this
Connection type used	The connection is via Network and using various communication types.	The connection is a point to point
Communication protocol used	Internet protocols are used such as HTTP, FTP, and Telnet.	Traditional protocols and communication technology techniques are used
Data Sharing	Data is shared between other applications that are used to improve the end-user experience.	Data is shared with only the communicating parties.
Internet	Internet connection is required for communication	Devices are not dependent on the Internet.
Scope	A large number of devices yet scope is large.	Limited Scope for devices.
Business Type used	Business 2 Business(B2B) and Business 2 Consumer(B2C)	Business 2 Business (B2B)
Open API support	Supports Open API integrations.	There is no support for Open Api's
Examples	Smart wearables, Big Data and Cloud, etc.	Sensors, Data and Information, etc.

Software Defined Network (SDN) :

Software-defined networking technology is an approach to network management that enables dynamic, programmatically efficient network configuration in order to improve network performance and monitoring, making it more like cloud computing than traditional network management.

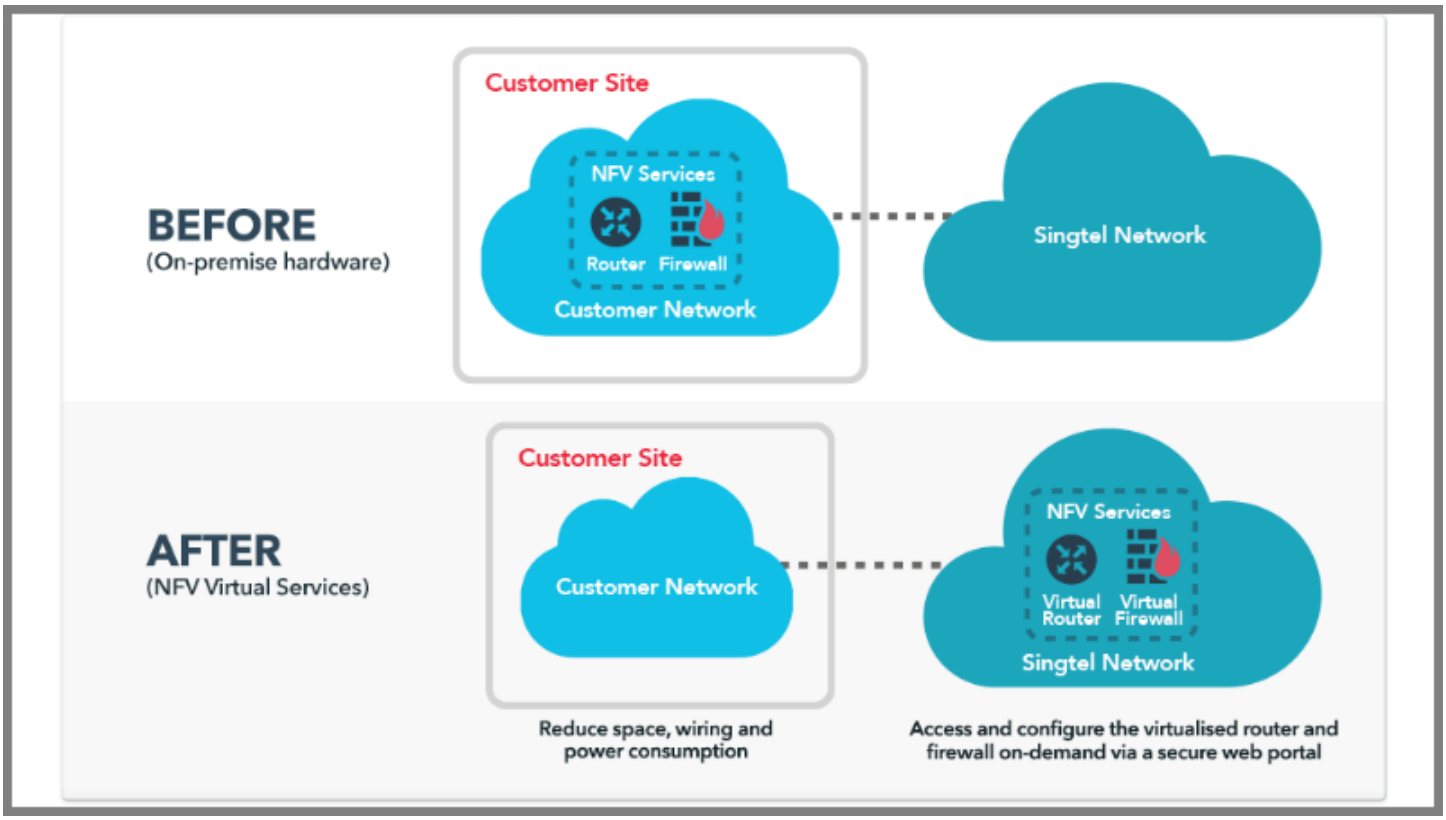


Key Element of SDN :

- Centralized Network Controller
  - With decoupled control and data planes and centralized network controller, the network administrators can rapidly configure the network.
- Programmable Open APIs
  - SDN architecture supports programmable open APIs for interface between the SDN application and control layers (Northbound interface).
- Standard Communication Interface (OpenFlow)
  - SDN architecture uses a standard communication interface between the control and infrastructure layers (Southbound interface).
  - OpenFlow, which is defined by the Open Networking Foundation (ONF) is the broadly accepted SDN protocol for the

Network Function Virtualization :

Network functions virtualization is a network architecture concept that uses the technologies of IT virtualization to virtualize entire classes of network node functions into building blocks that may connect, or chain together, to create communication services.



Key Element of NFV :

- Virtualized Network Function (VNF):
  - VNF is a software implementation of a network function which is capable of running over the NFV Infrastructure (NFVI).
- NFV Infrastructure (NFVI):
  - NFVI includes compute, network and storage resources that are virtualized.
- NFV Management and Orchestration:
  - NFV Management and Orchestration focuses on all virtualization-specific management tasks and covers the orchestration and life-cycle management of physical and/or software resources that support the infrastructure virtualization, and the life-cycle management of VNFs

Difference between SDN and NFV : (Long summary for Exam purpose)

Software defined Network	Network Function Visualization
SDN architecture mainly focuses on data centers.	NFV is targeted at service providers or operators.
SDN separates control plane and data forwarding plane by centralizing control and programmability of network.	NFV helps service providers or operators to virtualize functions like load balancing, routing, and policy management by transferring network functions from dedicated appliances to virtual servers.
SDN uses OpenFlow as a communication protocol.	There is no protocol determined yet for NFV.
SDN supports Open Networking Foundation.	NFV is driven by ETSI NFV Working group.
Various enterprise networking software and hardware vendors are initiative supporters of SDN.	Telecom service providers or operators are prime initiative supporters of NFV.
Corporate IT act as a Business initiator for SDN.	Service providers or operators act as a Business initiator for NFV.
SDN applications run on industry-standard servers or switches.	NFV applications run on industry-standard servers.
SDN reduces cost of network because now there is no need of expensive switches & routers.	NFV increases scalability and agility as well as speed up time-to-market as it dynamically allot hardware a level of capacity to network functions needed at a particular time.
Application of SDN: • Networking • Cloud orchestration	Application of NFV: • Routers, firewalls, gateways • WAN accelerators • SLA assurance • Video Servers • Content Delivery Networks (CDN)