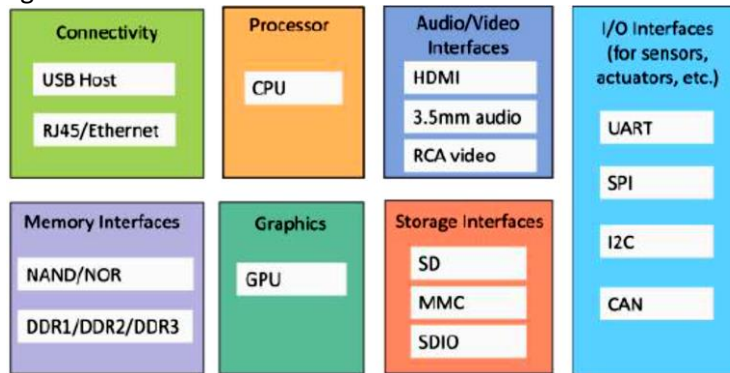# IOT March 2019 Insem Solution

1 a. Explain different functional blocks in an IOT system.
Ans. Generic Block Diagram of IOT Device

**1 b. Define Internet of Things (IOT). List applications of IOT.**
Ans. Internet of Things - IoT is twenty-first century phenomenon in which physical consumer products connect to the web and start communicating with each other by means of sensors and actuators.

Applications of IOT
- Smart City
- Smart Environment
- Smart Water
- Smart Metering
- Smart Agriculture
- Smart Animal Farming
- Home Automation
- eHealth

**2 a. Explain various components and their roles in Level-2 IoT System.**
Ans. Level-2 IoT System
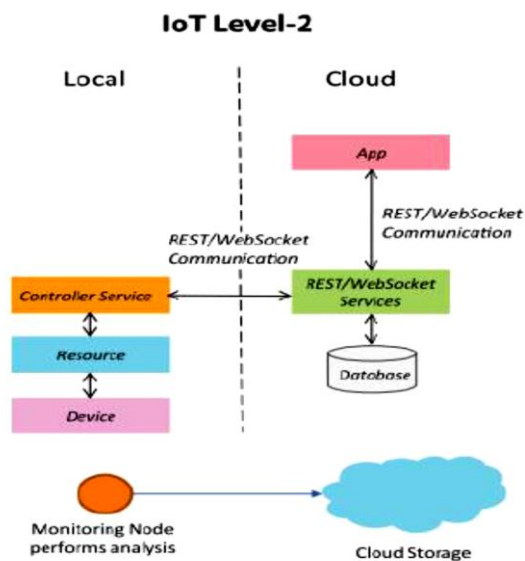
- A level-2 IoT system has a single node that performs sensing and/or actuation and local analysis
- Data is stored in the cloud and application is usually cloud based
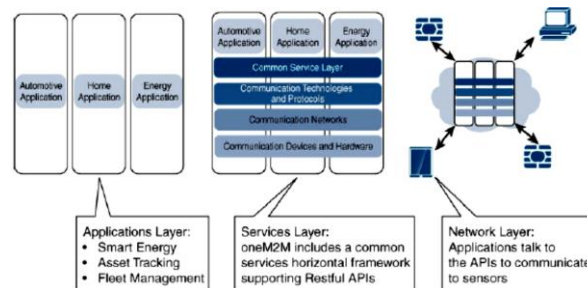- Level-2 IoT systems are suitable for solutions where the data involved is big

2 b. Describe how Publish Subscribe Model is used in IoT system.
Ans. Publish Subscribe Model
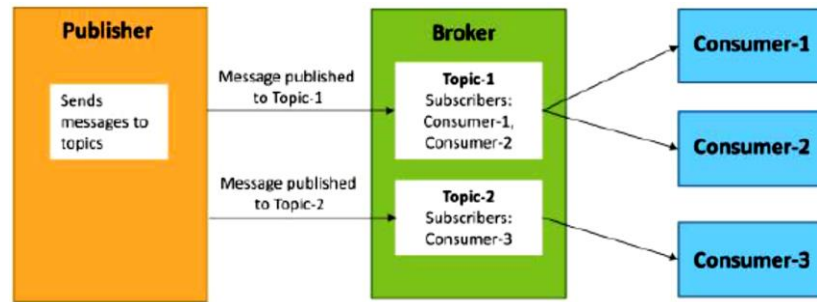
3 a. Explain in detail the One M2M IoT Standardize Architecture.
Ans.

Application Layer –
- The one M2M architecture gives major focus on connectivity between devices and their applications
- Includes the application-layer protocols
- Attempts to standardize northbound API definitions for interaction with BI systems
- Applications tend to be industry-specific and have their own sets of data models
- Thus shown as vertical entities

Service Layer –
- Shown as horizontal framework across the vertical industry applications
- At this layer, horizontal modules include
    - Physical network that IoT applications run on
    - Underlying management protocols
    - Hardware
- Examples include backhaul communications via cellular, MPLS networks, VPNs, and so on
- Riding on top is the common services layer.
- This conceptual layer adds APIs & middleware supporting third-party services & applications

Network Layer –
- Communication domain for the IoT devices and endpoints
- Includes devices themselves and the communications network that links them
- Examples include wireless mesh technologies, such as IEEE 802.15.4, and wireless point-to-multipoint systems, such as IEEE 801.11ah

**3 b. Describe key elements of SDN.**
Ans.
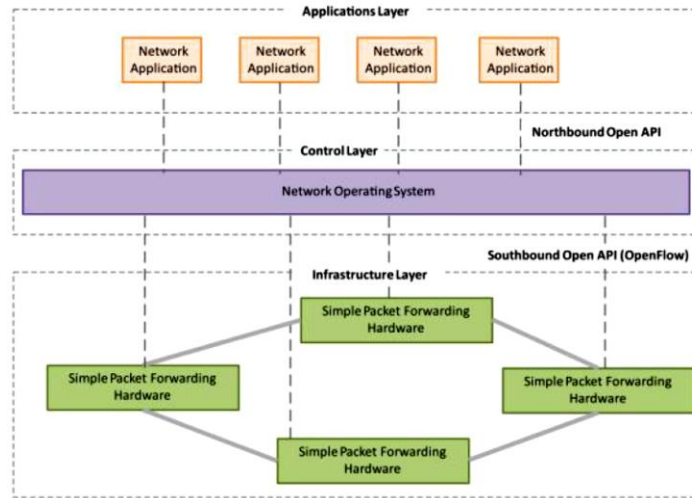
- Architecture that separate control plane from data plane and centralizes network controller
- SDN controllers maintain a unified view of the network & make configuration, management and provisioning simpler
- Underlying infrastructure in SDN uses simple packet forwarding hardware as opposed to specialized hardware in conventional network

4 a. What is NFV and how it is useful in IoT applications?
Ans.
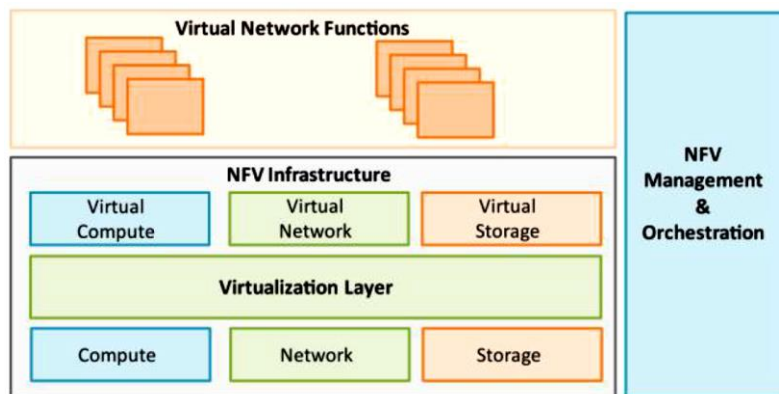
- Technology that controls virtualization to combine the heterogeneous network devices onto industry standard high volume servers, switches and storage
- NFV is complementary to SDN as NFV can provide infrastructure on which SDN can run

Key elements of NFV

Virtualized Network Function (VNF)

- Software implementation of network function which is capable of running over NFV Infrastructure

NFV Infrastructure

- Includes compute, network and storage resources that are virtualized

NFV Management and Orchestration

- Focuses on all virtualization-specific management tasks
- Covers orchestration and life-cycle management of physical and/or software resources that support the infrastructure virtualization, and the life-cycle management of VNFs

4 b. Write any five difference between IoT and M2M.

Ans.

| Topic	M2M	IOT
Communication Protocols	Proprietary or Non-IP Based	IP Based
Machines in M2M vs Things in IoT	Homogeneous Machine	Physical Objects that have Unique Identifiers
Hardware vs Software Emphasis	More On Hardware	More On Software
Data Collection & Analysis	Collected In Point Solutions And Often In On-premises Storage	Collected in The Cloud (Can Be Public, Private Or Hybrid Cloud
Applications	Diagnosis Applications, Service Management Applications, And On Premises Enterprise Applications	Analytics Applications, Enterprise Applications, Remote Diagnosis and Management Applications, etc.

5 a. Write short note on LoRaWAN.
Ans.
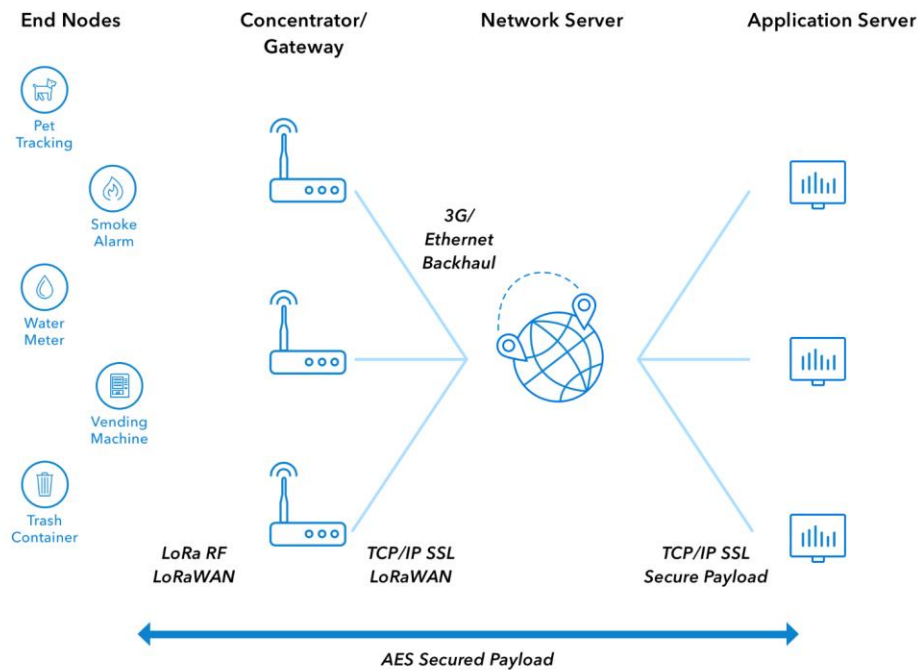
- Media access control (MAC) protocol for wide area networks
- Designed to allow low-powered devices to communicate with Internet-connected applications over long range wireless connections
- Can be mapped to the second and third layer of the OSI model

5 b. What type of sensors & actuators are used in IoT system?
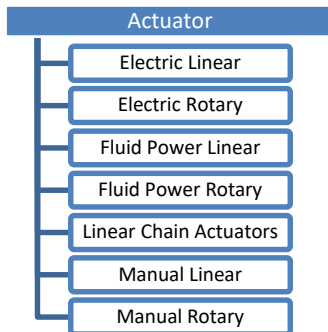Ans. Sensor –
- Characteristic of any device or material to detect presence of particular physical quantity
- Output of sensor is signal, which is converted to human readable form
- Performs some function of input by sensing or feeling physical changes in the characteristic of a system in response to stimuli
- Input: Physical parameter or stimuli
    - Example: Temperature, light, gas, pressure, and sound
- Output: Response to stimuli

Classification
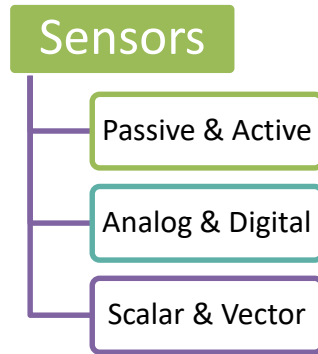
Actuator –
- Part of system that deals with the control action required (mechanical action)
- Mechanical or electro-mechanical devices
- A control signal is input to an actuator and an energy source is necessary for its operation
- Available in both micro and macro scales
- Example:
  - Electric Motor,
  - Solenoid,
  - Hard Drive Stepper Motor
  - Comb Drive

6 a. Define sensor network? Write advantages and disadvantages of Wireless Sensor Network over Wired Sensor Network.
Ans. Sensor Network –
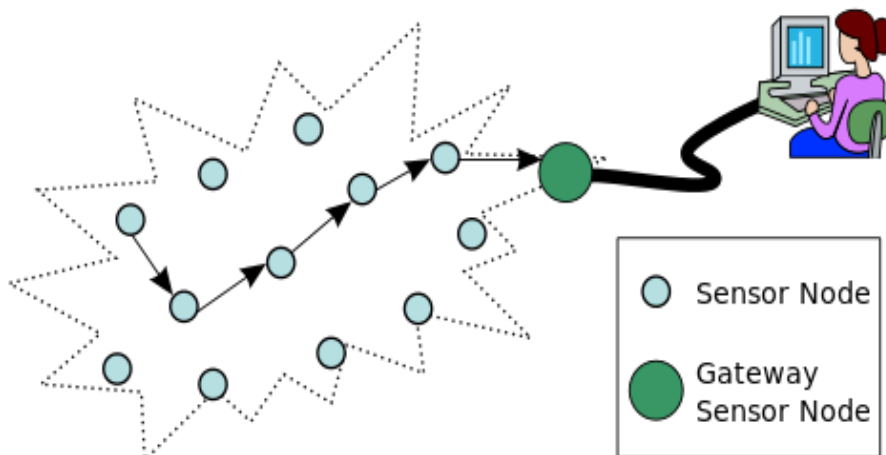
Advantages –
- Wireless sensor networks are used in those harsh and hostile environments where wired networks can't be deployed. For example, in a forest, wireless sensor nodes are dropped from the air because going down there and deploying a wired setup is not possible.
- Another advantage is that the wireless sensor networks are scalable. That is why they are actively being used in applications such as Structural Health Monitoring where there is a need of dense deployment and with a dense wired set up, it may lead to a chaos at the time of deployment. Moreover, a dense wired set up will prove to be very costly. On the other hand, wireless sensor nodes can easily be deployed without any hustle.

Disadvantages–
- Limited computation and communication resources are the only disadvantages in wireless sensor networks. They have limited battery power, limited storage and computation capabilities, prone to the security attacks and have limited bandwidth to communicate.
- Despite of the above disadvantages, sensor networks are being used widely and considered to be the backbone of the phenomenon we call "Internet of Things".

6 b. Describe any four communication criteria to be considered while connecting Smart Objects.
Ans. Communication Criteria
- Range
- Frequency bands
- Power consumption
- Topology
- Constrained devices
- Constrained node networks