CT106-3-M-BIA - Building IoT Applications

CT127-3-M-ODL - BIA - Building IoT Applications

Topic 3 - IoT Architecture & Design

TOPIC LEARNING OUTCOMES

At the end of this topic, you should be able to:

- Understand the concept of IoT architecture and its significance in organizing and structuring IoT systems.
- Identify and describe the layers in IoT architecture, including Sensor Connectivity & Network, Gateway & Network, Management Service, and Application.
- Explain the role and function of each IoT architecture layer in enabling efficient and secure communication and data flow.
- Analyze the interdependencies and interactions between different IoT architecture layers.
- Evaluate the requirements and considerations for designing and implementing each IoT architecture layer.

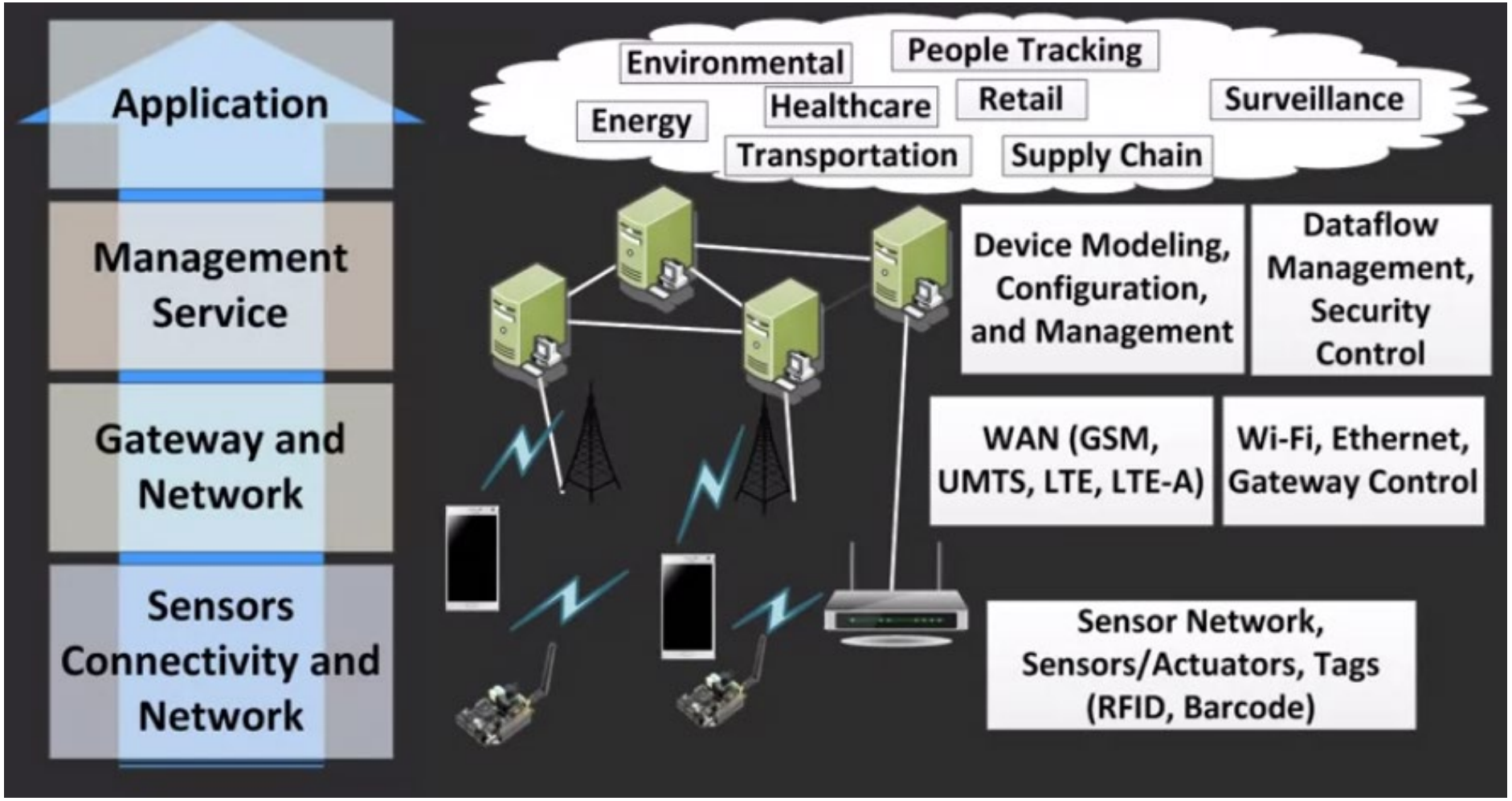
Contents & Structure

- IoT Architecture
- IoT Architecture Layers
  - Sensor Connectivity & Network
  - Gateway & Network
  - Management Service
  - Application

IoT Architecture

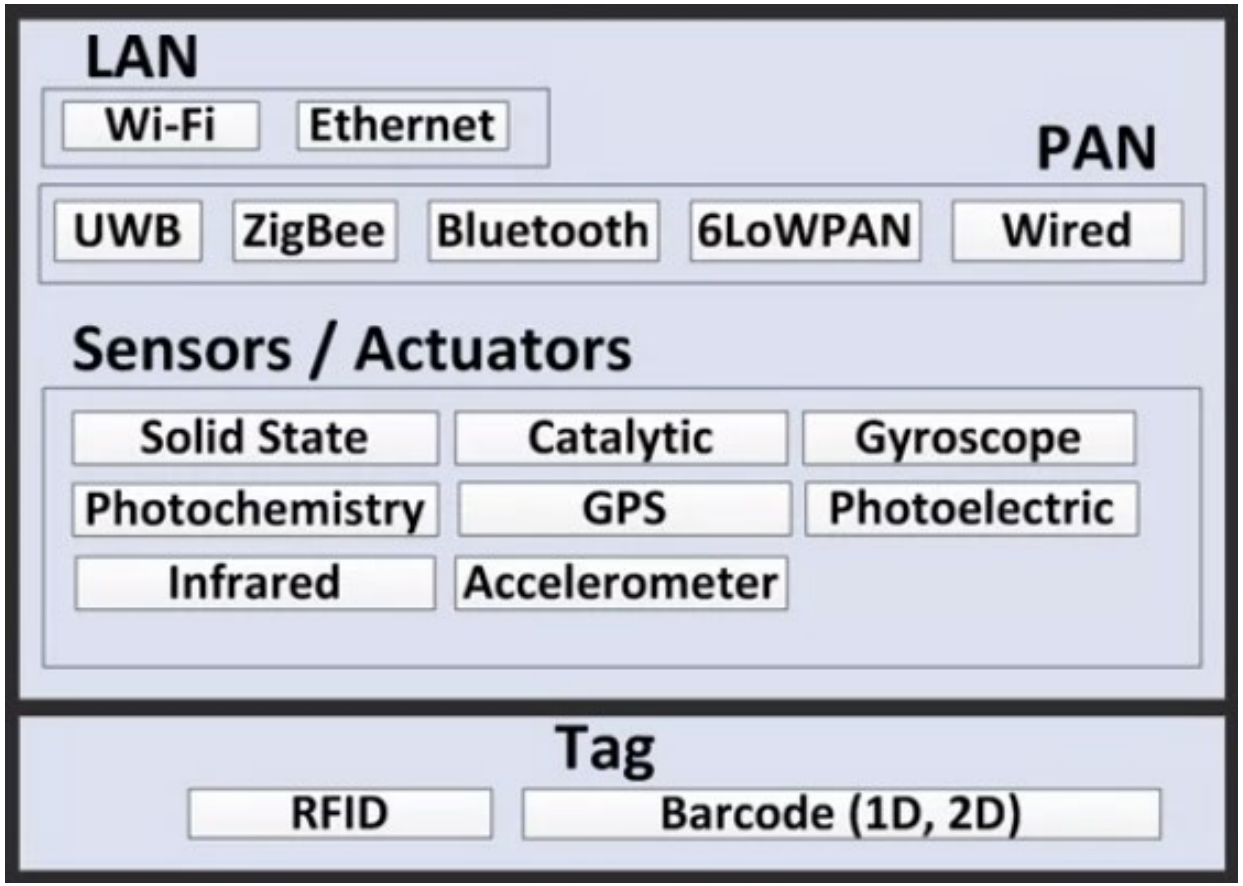
- IoT architecture refers to the framework or structure that defines how various components and layers of an Internet of Things (IoT) system are organized and interact with each other.
- It provides a blueprint for designing, deploying, and managing IoT solutions.
- The architecture can vary depending on the specific IoT implementation, and additional layers or components may be included based on the requirements of the system.

IoT Architecture Layers



Sensor Connectivity & Network

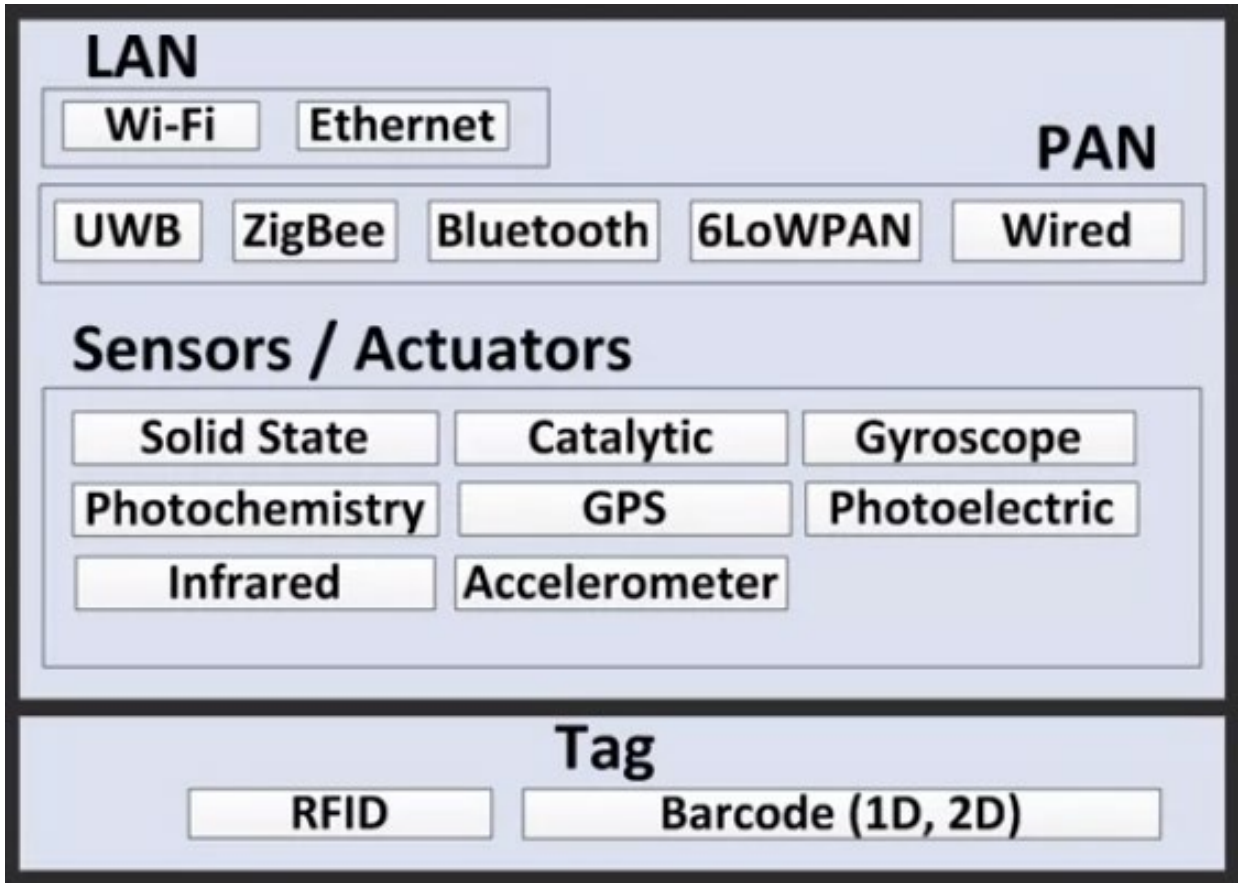
- This layer consists of sensors (which are responsible for collecting raw data).
- Sensors and RFID tags are wireless devices that form the Wireless Sensor Networks (WSN).
- This layer also has network connectivity (like LAN, PAN etc.) which is responsible for communicating the raw data to the next layer.
- The devices which are comprised of WSN have finite storage capacity, restricted communication bandwidth and small processing speed.



Sensor Connectivity & Network

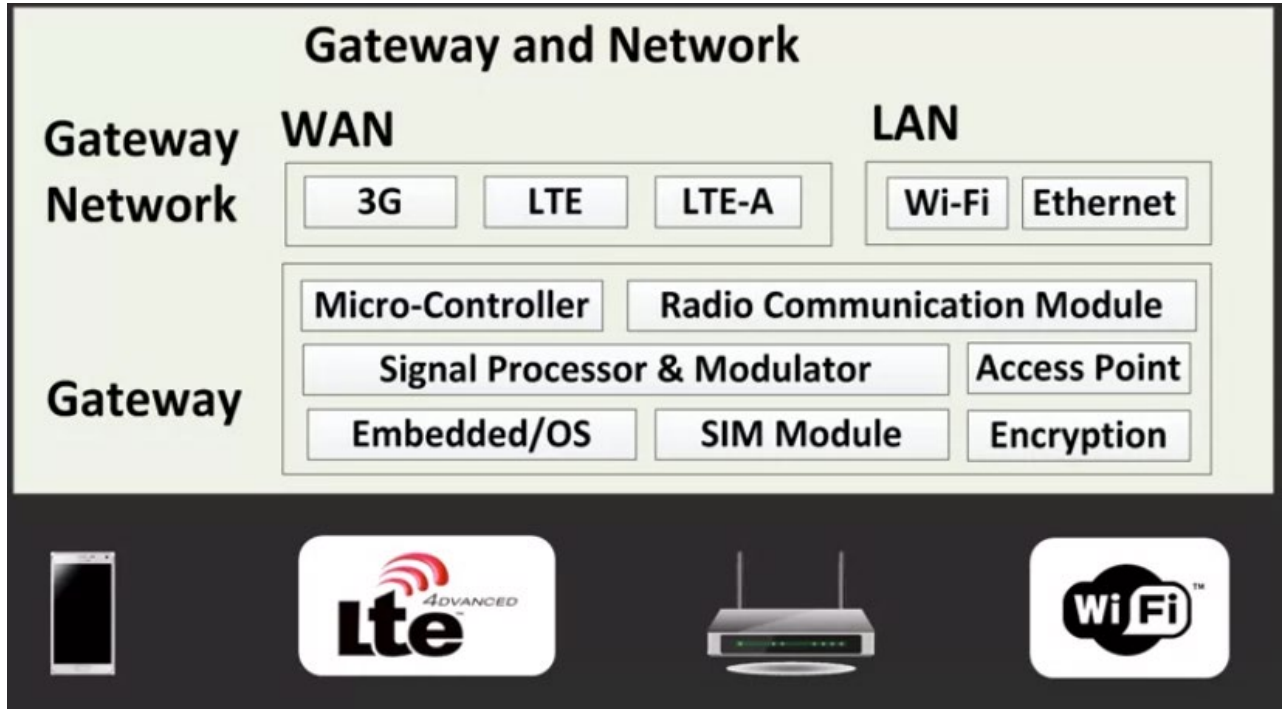
Different sensors are available for different applications:

- temperature sensor for collecting temperature data,
- water quality for examining water quality,
- moisture sensor for measuring moisture content of the atmosphere or soil etc.



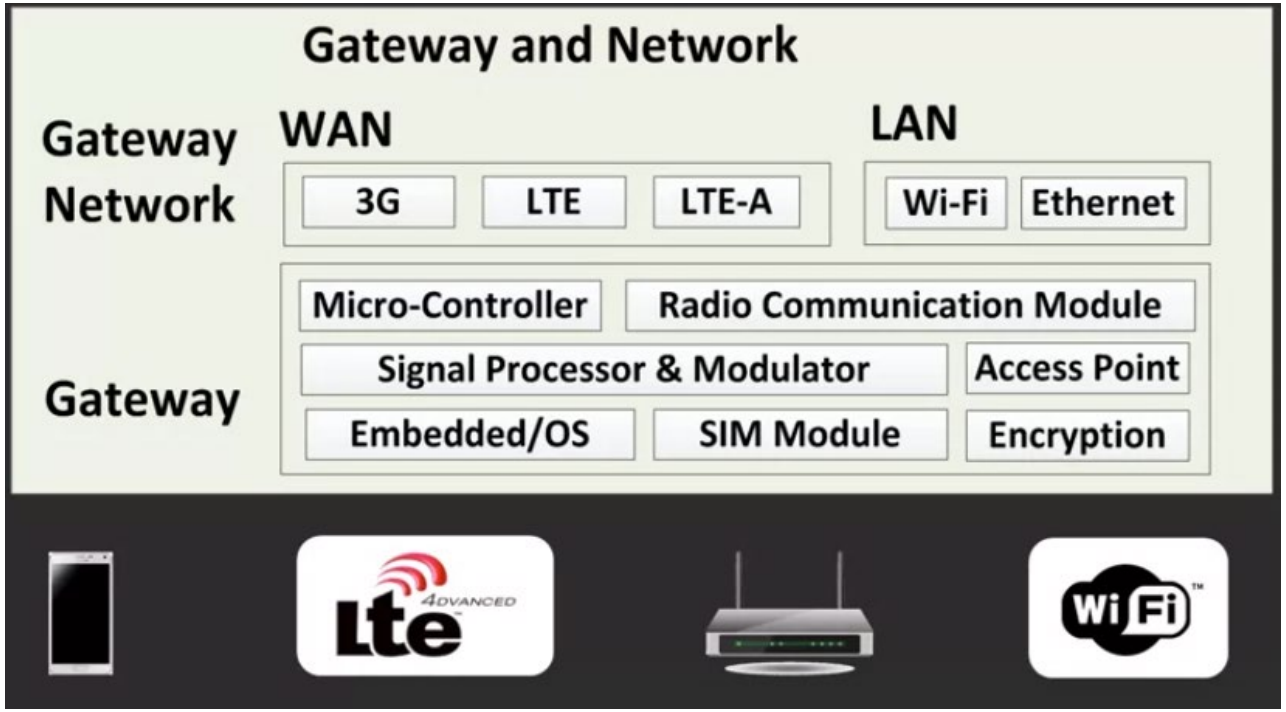
Gateway & Network

- Gateways are responsible for routing the data coming from the **Sensor, Connectivity and Network layer** and passing it to the **Management Service Layer**.
- This layer requires having a large storage capacity for storing the enormous amount of data collected by the sensors, RFID tags etc. Also, this layer needs to have a consistently trusted performance in terms of public, private and hybrid networks.
- Different IoT device works on different kinds of network protocols. All these protocols are required to be assimilated in a single layer. This layer is responsible for integrating various network protocols.



Gateway & Network

A gateway is comprised of embedded OS, Signal Processors and Modulators, Micro-Controllers etc. Above the gateway we have the Gateway Networks which are LAN(Local Area Network), WAN(Wide Area Network) etc.



Management Service

- This layer is used for managing the IoT services. Management Service layer is responsible for Securing Analysis of IoT devices, Analysis of Information (Stream Analytics, Data Analytics), and Device Management.
- Data management is required to extract the necessary information from the enormous amount of raw data collected by the sensor devices to yield a valuable result of all the data collected. This action is performed in this layer.
- Also, certain situation requires immediate response to the situation. This layer helps in doing that by abstracting data, extracting information and managing the data flow.
- This layer is also responsible for data mining, text mining, service analytics etc.

Management Service

- Management service layer has Operational Support Service (OSS) which includes Device Modeling, Device Configuration and Management etc. Also, we have the Billing Support System (BSS) which supports billing and reporting.
- There are IoT/M2M Application Services which includes
  - Analytics Platform
  - Data
  - Security
  - Business Rule Management (BRM)
  - Business Process Management (BPM)

Application Layer

- Application layer forms the topmost layer of IoT architecture responsible for effectively utilising the data collected.
- Various IoT applications include Home Automation, E-health, E-Government etc.
- There are two types of applications: Horizontal Market which includes Fleet Management, Supply Chain, etc. and Sector-wise applications which include energy, healthcare, transportation etc.

Review Questions

- What are the key components and functions of the Sensor Connectivity & Network layer in IoT architecture?
- How do gateway devices facilitate communication between sensors and the wider network infrastructure in IoT systems?
- How does the Management Service layer enable monitoring, control, and maintenance of IoT devices and networks?
- Explain the concept of remote device management and its significance in the Management Service layer.
- What are some common application scenarios and use cases for IoT systems in the Application layer?

What To Expect Next Week

In Class

Preparation for Class