Dr . SNS RAJALAKSHMI COLLEGE OF ARTS AND SCIENCE
COIMBATORE

DEVELOPING INDUSTRIAL IoT

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Department of Computer Applications

SYLLABUS

UNIT – 01 : INTRODUCTION TO IoT

Definition - Market Size - IoT v IoT Scope - History - Vertical and Business Process areas - Leading companies - Importance of building Ecosystems - IoT Value Chain – who does what? IOT Platform, Interfaces, API, clouds, Data Management Analytics, Mining &Manipulation; Role of IOT in Manufacturing Processes Use of IOT in plant maintenance practices, Sustainability through Business excellence tools Challenges & Benefits in implementing IOT.

UNIT – 02 : ARCHITECTURES

Overview of IOT components; Various Architectures of IOT and IIOT, Advantages &disadvantages, Industrial Internet - Reference Architecture; IIOT System components: Sensors, Gateways, Routers, Modem, Cloud brokers, servers and its integration, WSN, WSN network design for IOT.

UNIT – 03 : SENSOR AND INTERFACING

Introduction to sensors. Transducers, Classification, Roles of sensors in IOT, Various types of sensors, Design of sensors, sensor architecture, special requirements for IOT sensors, Role of actuators, types of actuators. Hardwire the sensors with different protocols such as HART, MODBUS-Serial & Parallel, Ethernet, BACNET, Current, M2M.

UNIT – 04 : PROTOCOLS AND CLOUD NEED OF PROTOCOLS

Types of Protocols, Wi-Fi, Wi-Fi direct, Zigbee, Z wave, BACNET, BLE, Modbus, SPI, I2C, IOT protocols –COAP, MQTT,6lowpan, lwm2m, AMPQ IIOT cloud platforms: Overview of cots cloud platforms, Predix, thing works, azure etc. Data analytics, cloud services, Business models: Saas, Paas, Iaas.

UNIT – 05 : PRIVACY, SECURITY AND GOVERNANCE

Introduction to web security, Conventional web technology and relationship with IIOT, Vulnerabilities of IoT, Privacy, Security requirements, Threat analysis, Trust, Analytics and Applications Role of Analytics in IOT, Data visualization Techniques Internet of Things Applications : Smart Metering, e-Health Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Plant Automation, Real life examples of IOT in Manufacturing Sector.

TEXT BOOK:

Daniel Minoli , “Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications”, ISBN: 978-1-118-47347-4, Willy Publications 2. Bernd Scholz-Reiter, Florian.

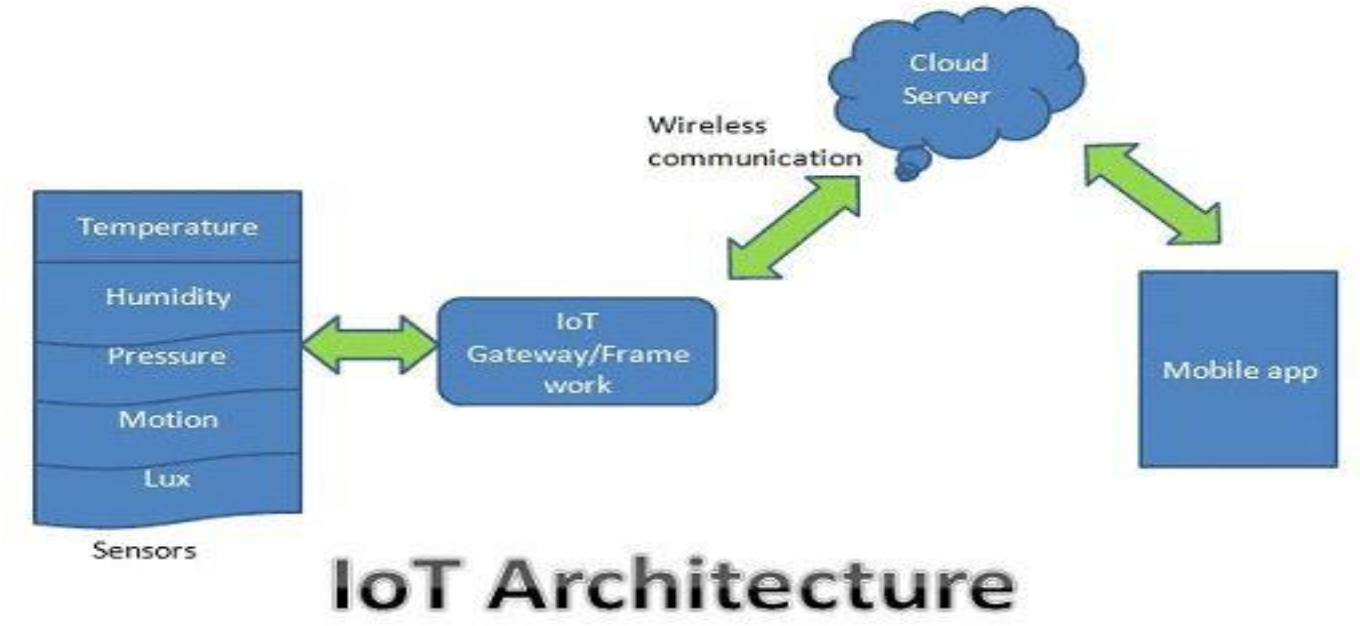
REFERENCE BOOK:

1) Michahelles, “Architecting the Internet of Things”, ISBN 978-3- 642-19156-5 e- ISBN 978-3-642-19157-2, Springer.
2) Hakima Chaouchi, “The Internet of Things Connecting Objects to the Web” ISBN: 978-1-84821-140-7, Willy Publications
3) Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, ISBN: 978-1-119-99435-0, 2 nd Edition, Willy Publications.

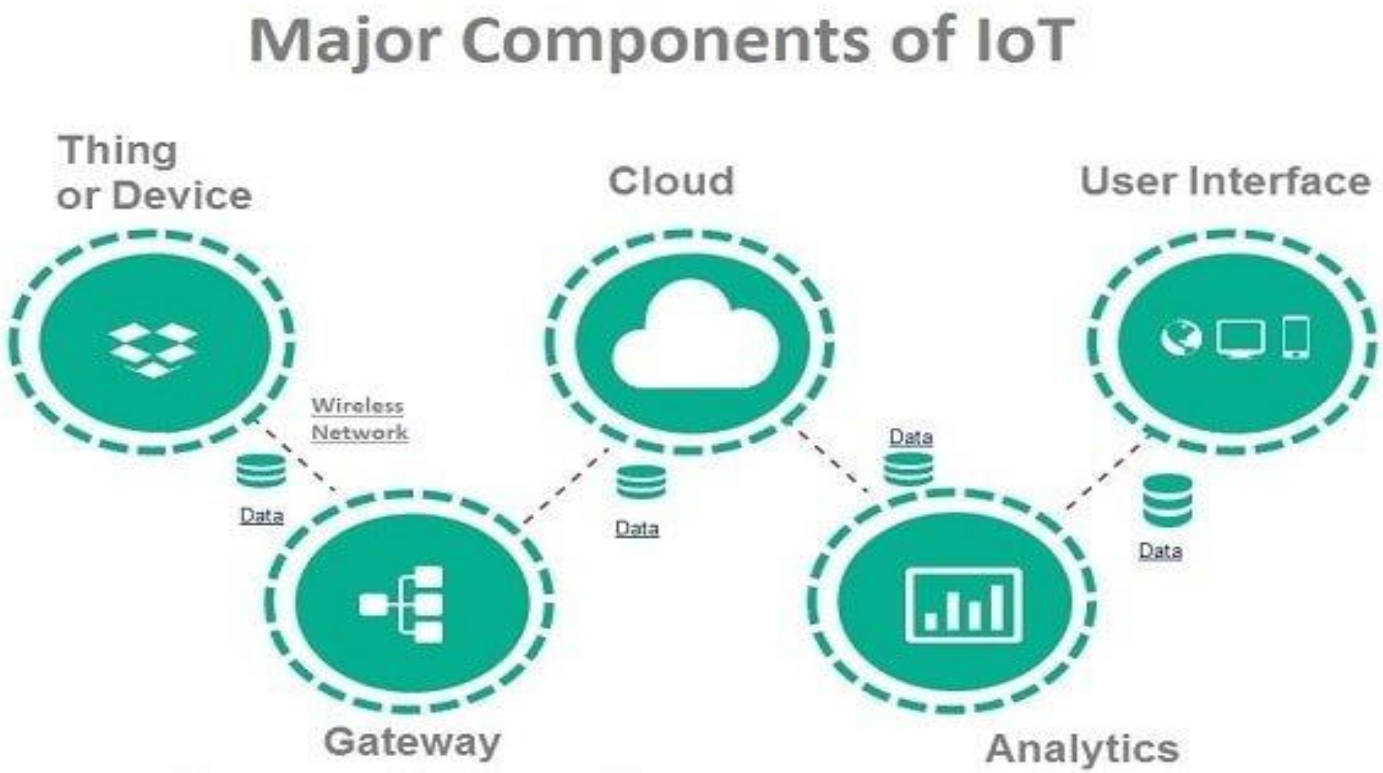
UNIT – 02: ARCHITECTURES

DEFINITION:

The Internet of Things (IoT) architectures refer to the systematic design and arrangement of interconnected devices, sensors, networks, and data processing components that enable seamless communication, data exchange, and intelligent decision-making within the IoT ecosystem. These architectures typically involve edge devices, communication protocols, cloud services, and analytics platforms, creating a framework for collecting, transmitting, and analyzing data from diverse IoT endpoints. The goal is to facilitate efficient and secure interaction among devices to enable automation, monitoring, and optimization across various industries and applications.



OVERVIEW OF IOT COMPONENTS:



1) **Thing or Device:**

These are physical objects embedded with sensors, actuators, and communication interfaces.
EX: Smart Sensors, Wearables, Industrial Machines, Home Appliances, and More.

2) Gateway:

- ✓ Acts as a bridge between IoT devices and the cloud.
- ✓ Aggregates and preprocesses data before forwarding it to the cloud.

3) Analytics:

- ✓ Processes and analyzes the vast amounts of data generated by IoT devices.

4) Cloud:

- ✓ Cloud platforms store and analyze large volumes of IoT data.
- ✓ Provide services such as data storage, processing, and machine learning for insights.

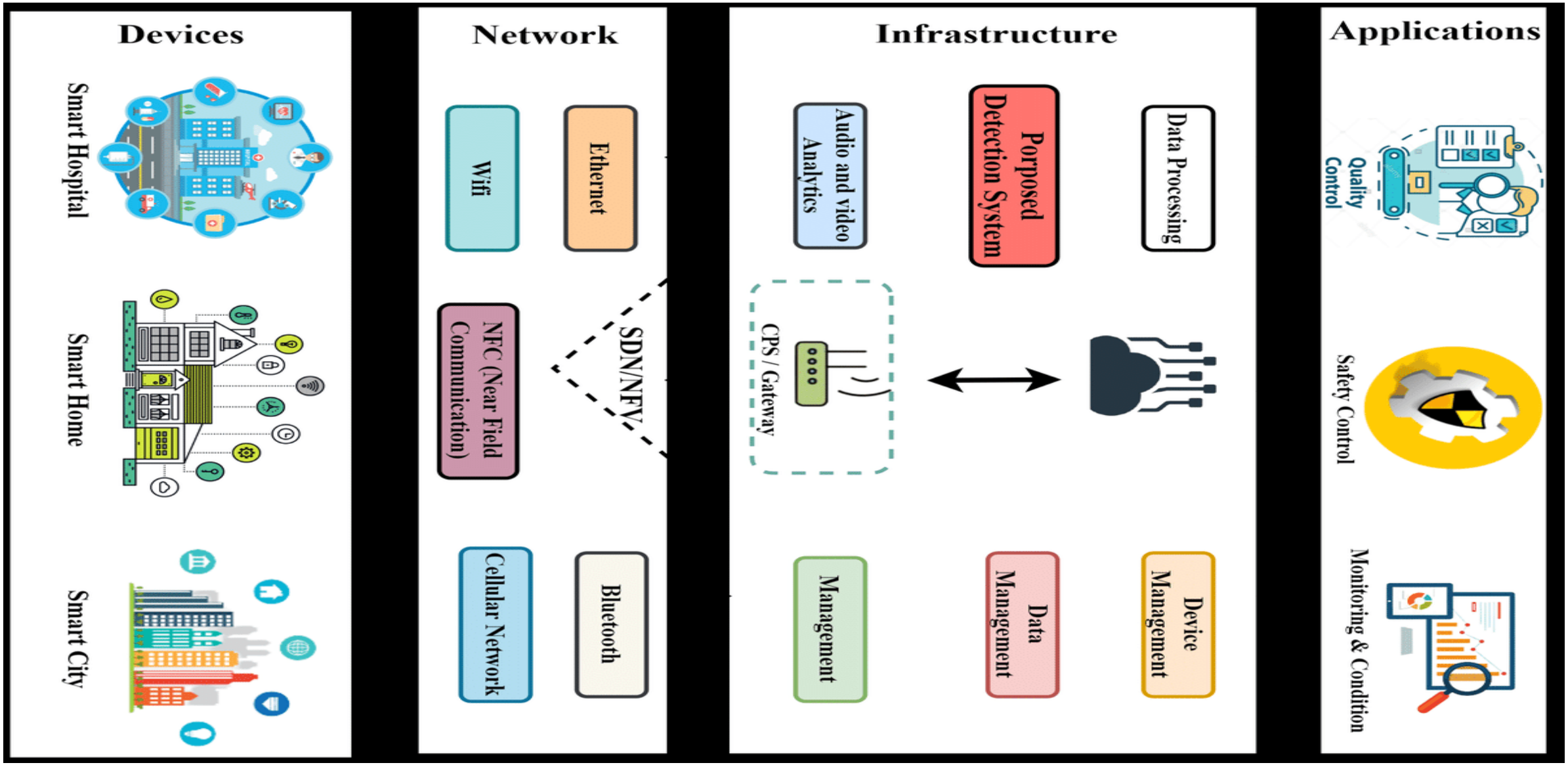
5) User-Interface:

- ✓ Interfaces for end-users or administrators to interact with IoT systems.
- ✓ Can be web-based dashboards, mobile apps, or other user-friendly interfaces.

Various Architectures of IOT and IIOT:

The architectures of the Internet of Things (IoT) and the Industrial Internet of Things (IIoT) can vary based on specific use cases, requirements, and industry standards.

ARCHITECTURE OF IoT:



ADVANTAGES AND DISADVANTAGES OF IOT:

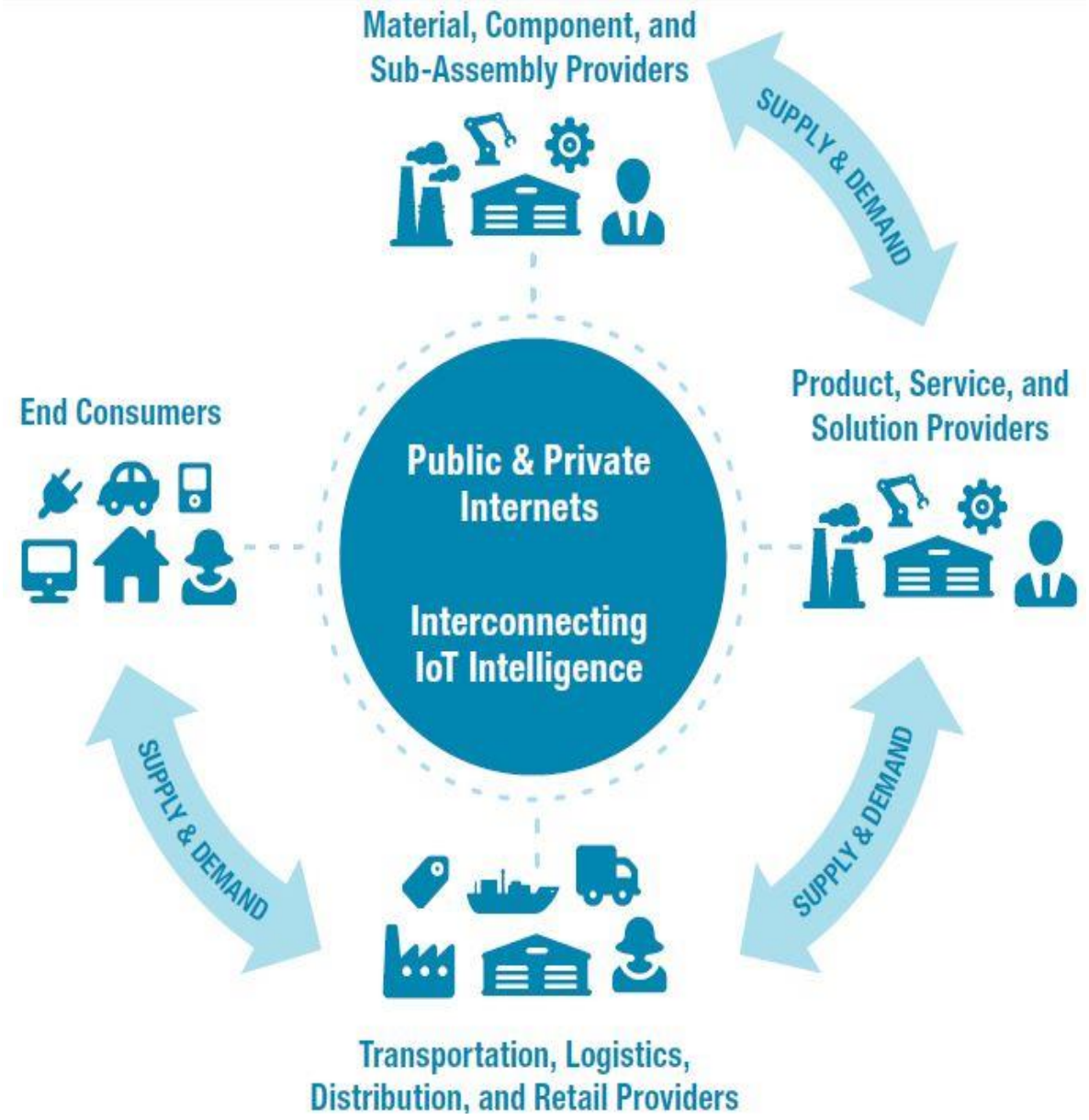
Advantages	Disadvantages
Minimizes the human work and effort	Increased privacy concerns
Saves time and effort	Increased unemployment rates
Good for personal safety and security	Highly dependent on the internet
Useful in traffic and other tracking or monitoring systems	Lack of mental and physical activity by humans leading to health issues.
Beneficial for the healthcare industry	Complex system for maintenance
Improved security in homes and offices	Lack of security
Reduced use of many electronic devices as one device does the job of a lot of other devices	Absence of international standards for better communication

INDUSTRIAL IOT:

The Industrial Internet of Things (IIoT) is the application of IoT technologies in industrial sectors, involving the integration of smart devices, sensors, and data analytics to enhance efficiency, productivity, and decision-making in industrial processes.

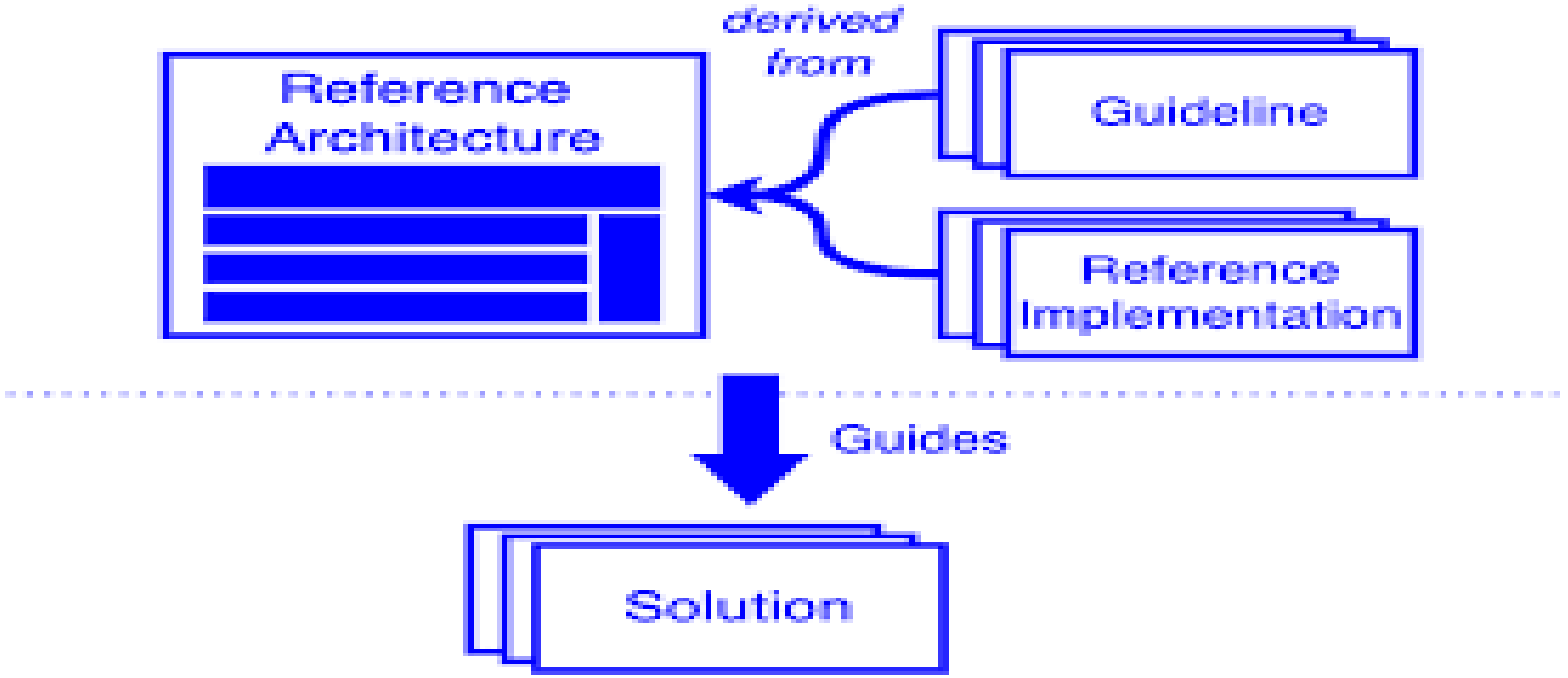
INDUSTRIAL
IOT
(INTERNET OF THINGS)

IIoT is used for industrial purpose such as manufacturing, supply chain monitor and management system.



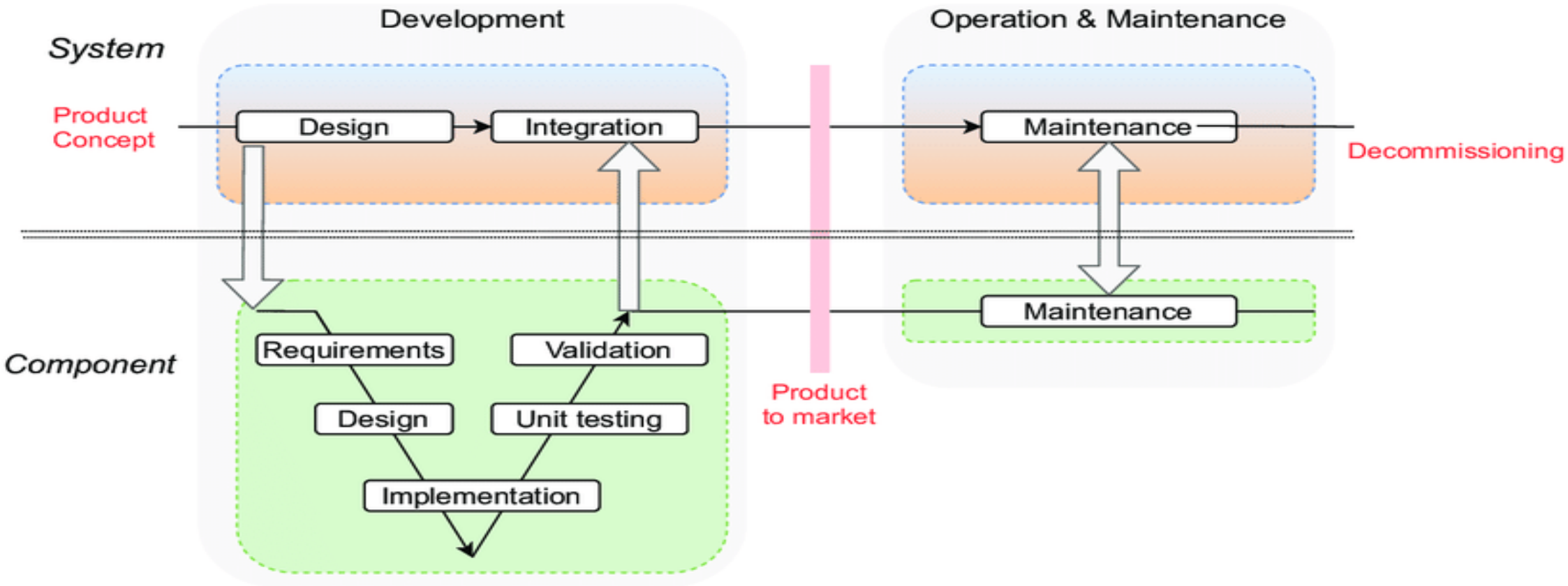
REFERENCE ARCHITECTURE:

A reference architecture is a standardized framework that provides a common blueprint, structure, and set of guidelines for designing and implementing solutions within a particular domain or industry. It serves as a reference model that captures best practices, design principles, and recommended patterns to address common challenges and requirements.



IIOT SYSTEM COMPONENTS:

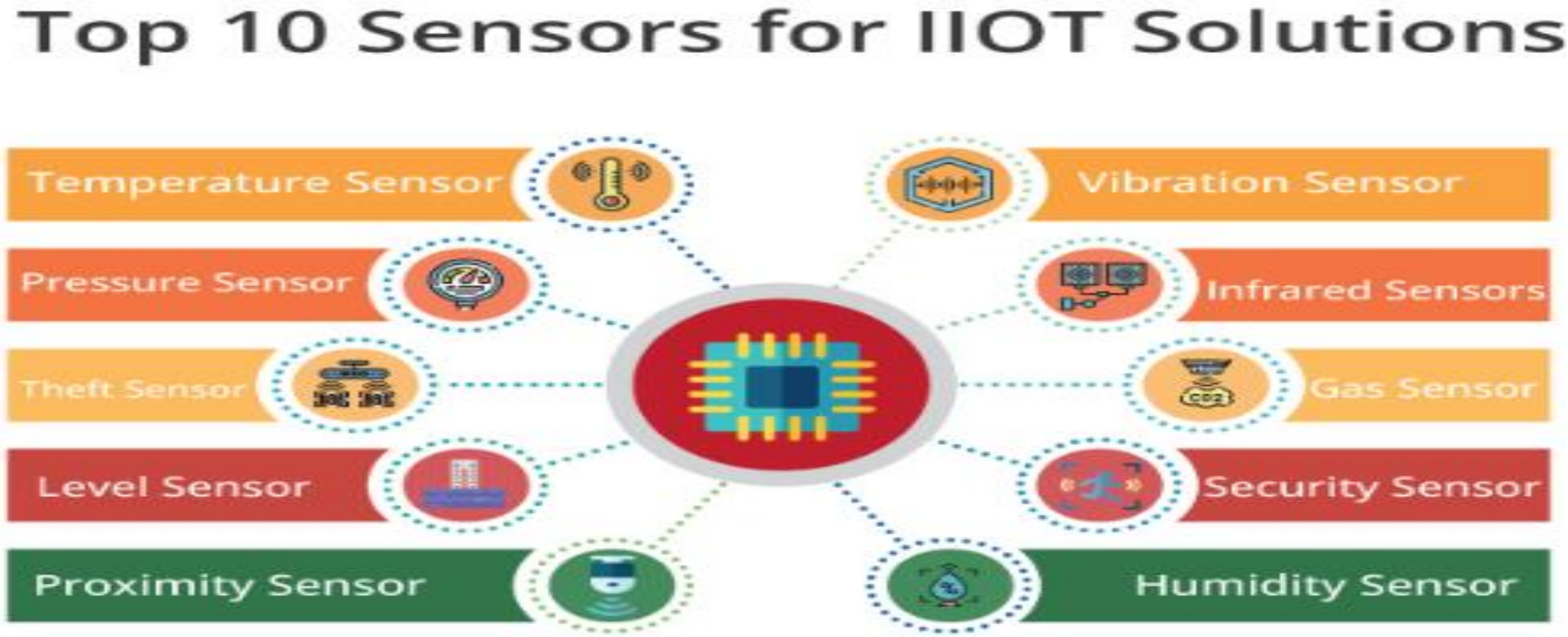
An Industrial Internet of Things (IIoT) system comprises various components that work together to enable the seamless integration of smart devices, data exchange, and advanced analytics within an industrial environment.



IIOT SENSOR:

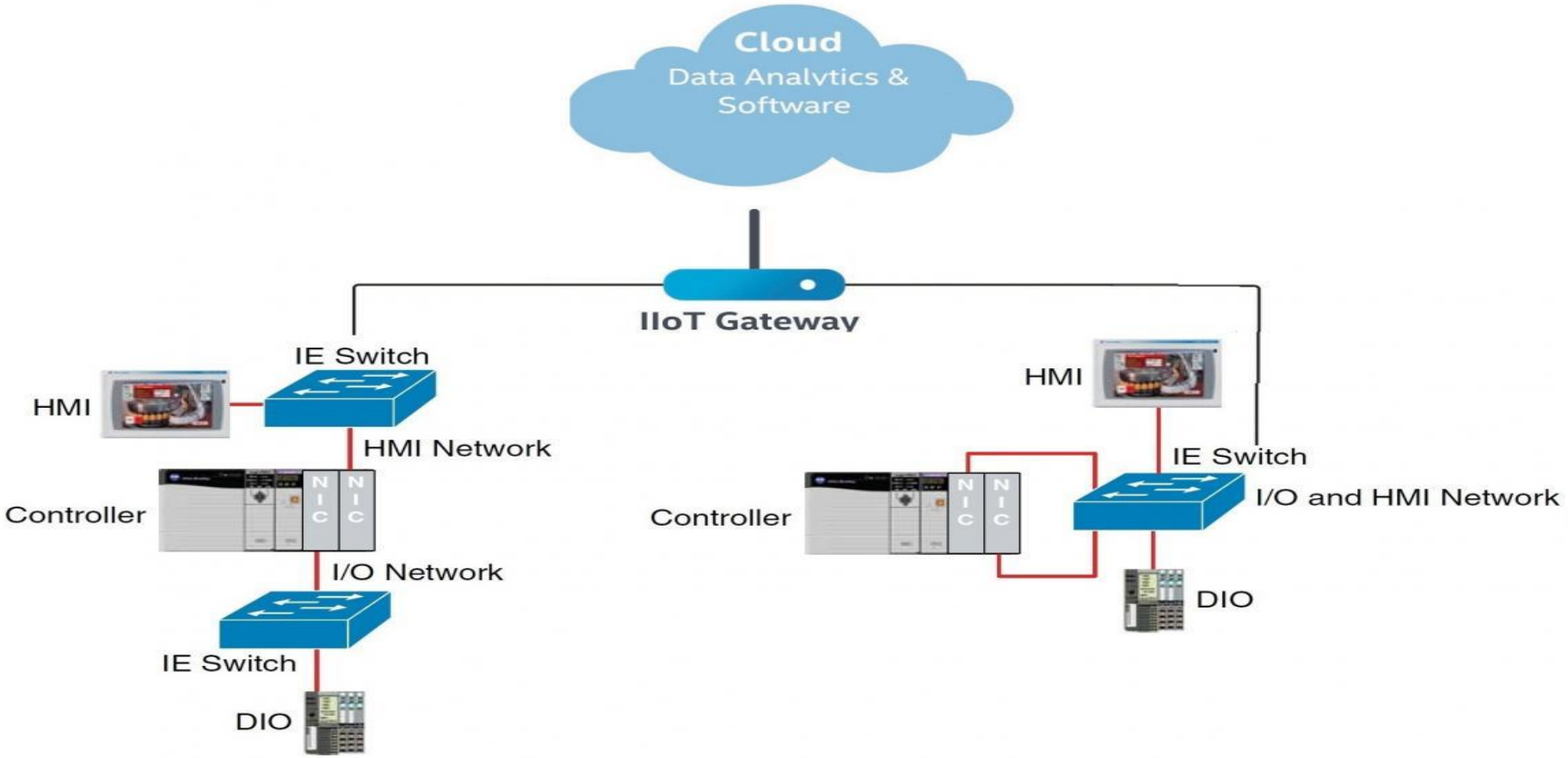
In Industrial Internet of Things (IIoT) applications, sensors play a critical role in collecting real-time data from the physical environment. These sensors are instrumental in monitoring and controlling industrial processes, ensuring safety, and enabling data-driven decision-making.

TYPES OF IIOT SENSORS:



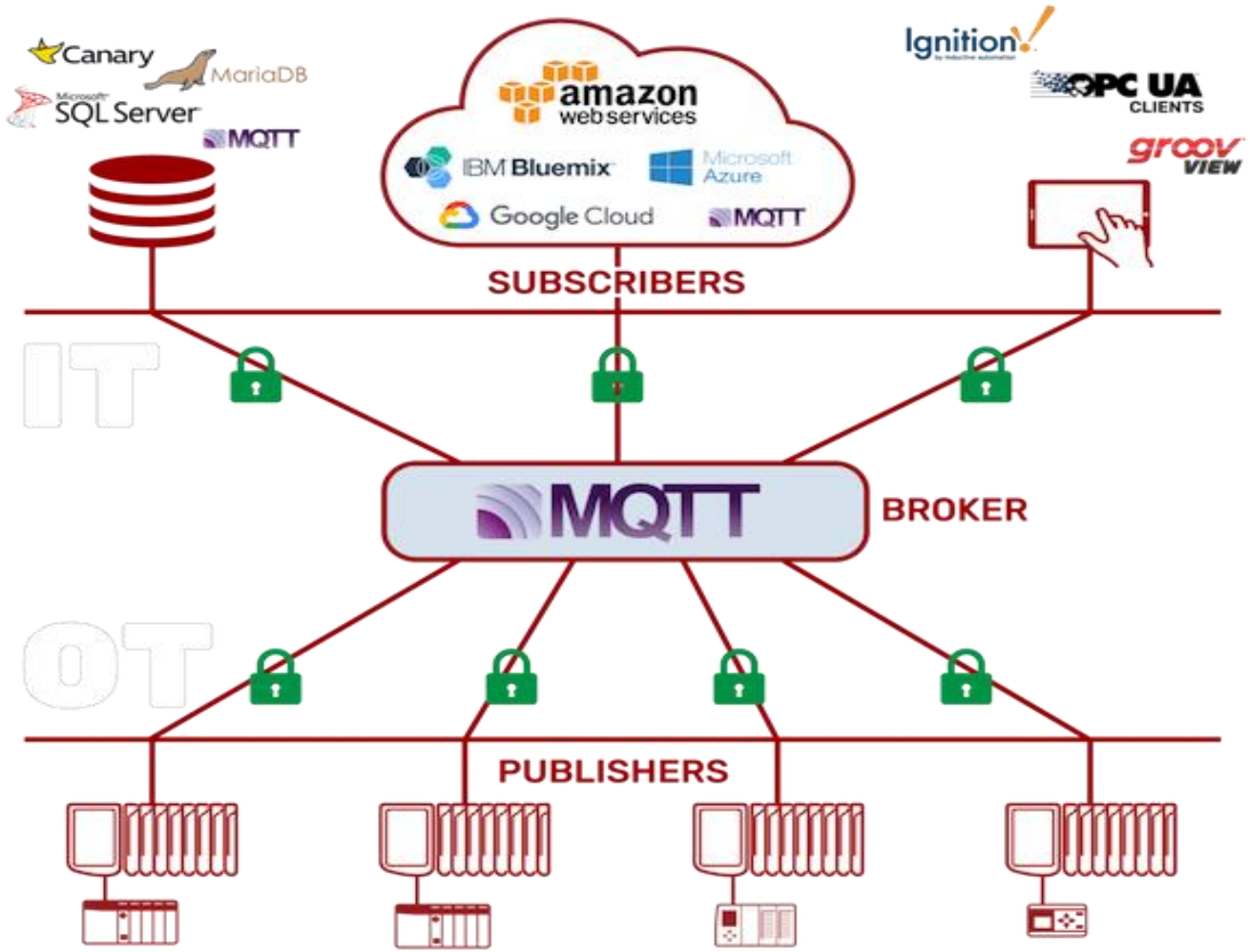
IIOT GATEWAY:

An Industrial Internet of Things (IIoT) gateway is a crucial component in IIoT architectures that serves as a bridge between devices on the factory floor or industrial environment and the broader IIoT network or cloud. It plays a vital role in facilitating communication, data aggregation, and preprocessing before transmitting information to higher-level systems.



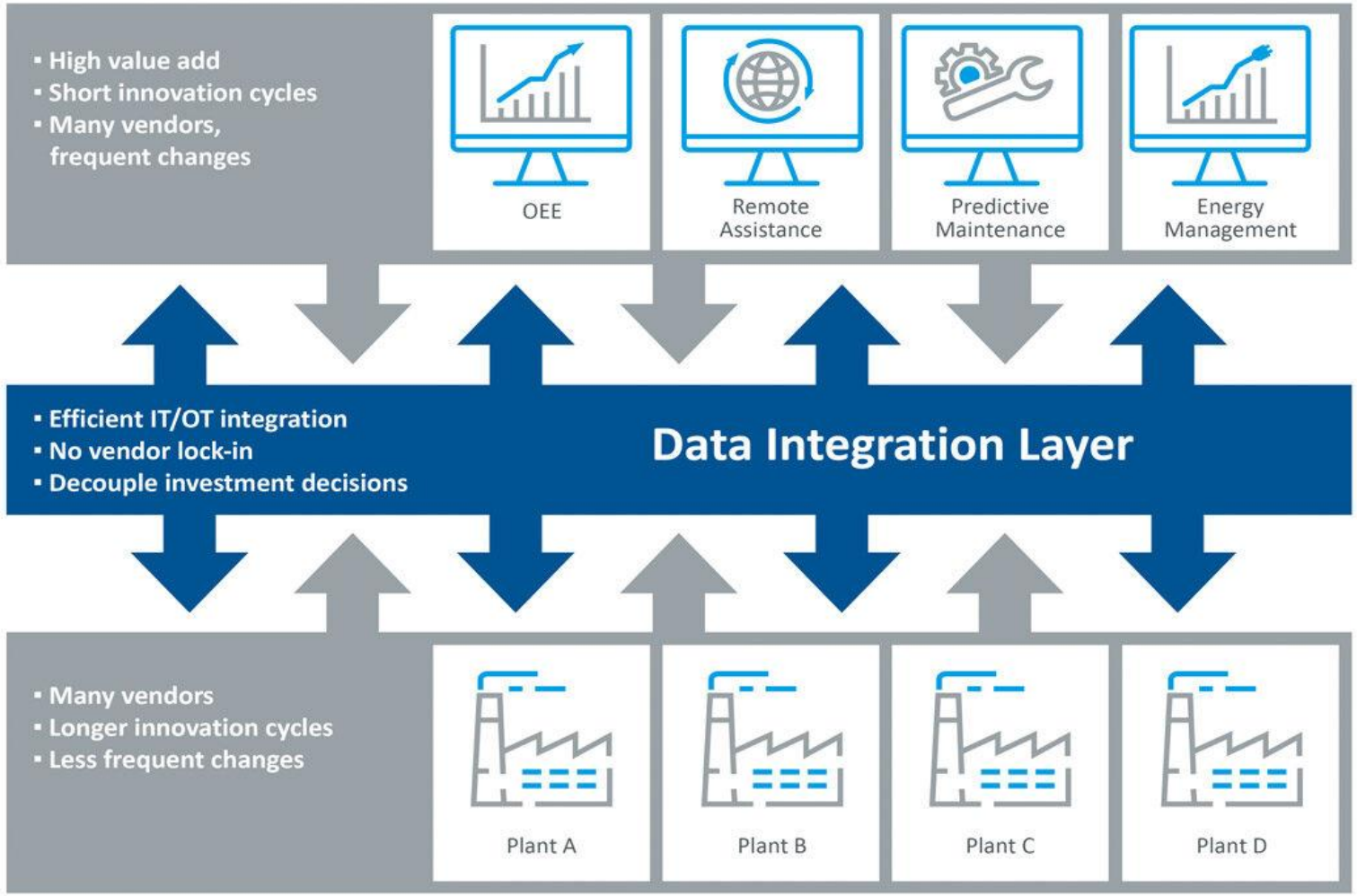
IIOT CLOUD BROKERS:

As of my last knowledge update in January 2022, the concept of "IIoT Cloud Brokers" doesn't represent a widely recognized term in the field of Industrial Internet of Things (IIoT).



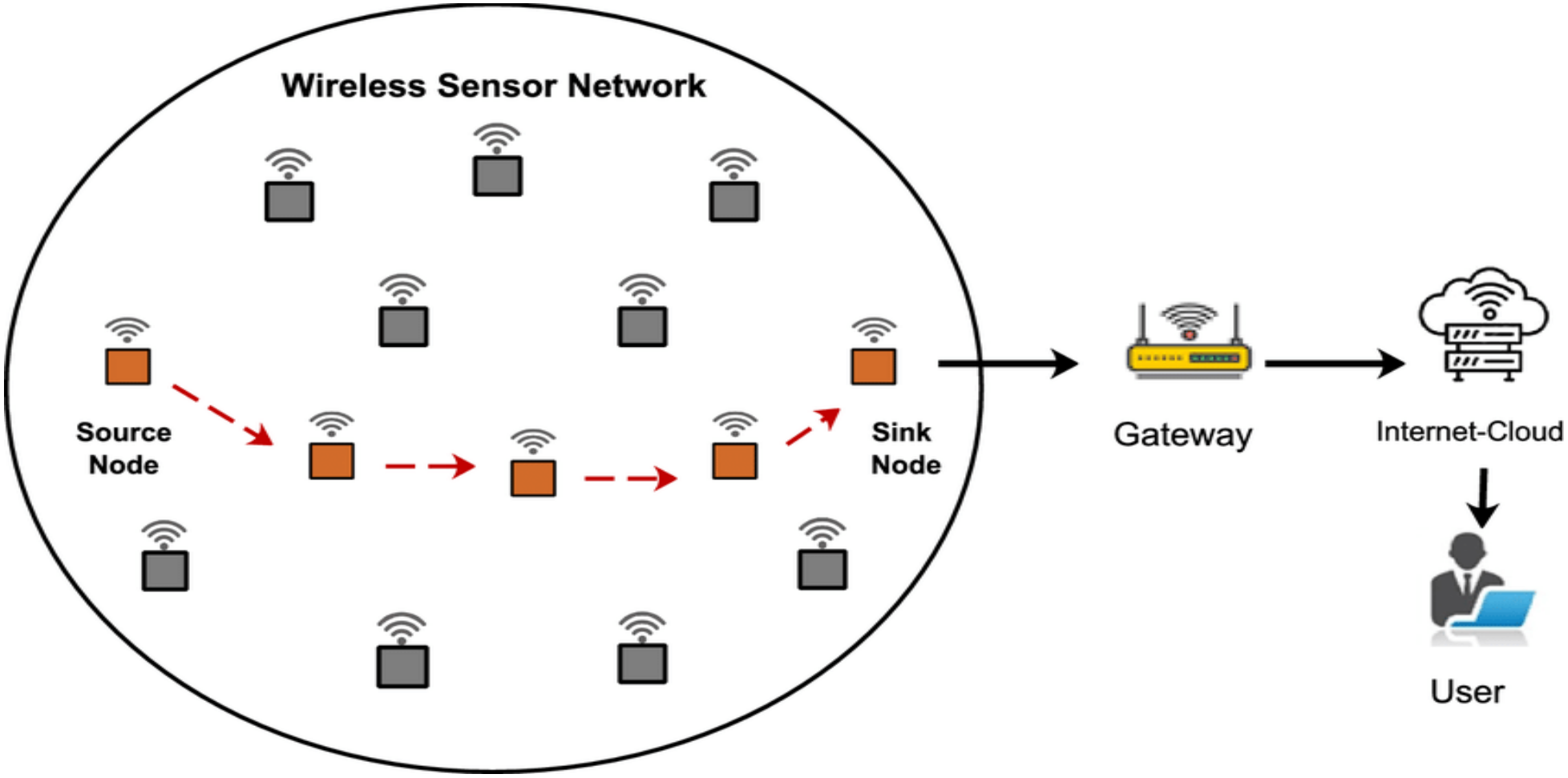
IIOT SERVERS AND IT'S INTEGRATION:

In an Industrial Internet of Things (IIoT) system, servers play a crucial role in managing, storing, and processing data generated by connected devices and sensors. The integration of IIoT servers involves linking these servers with various components of the IIoT ecosystem, including edge devices, gateways, cloud services, and other infrastructure elements.

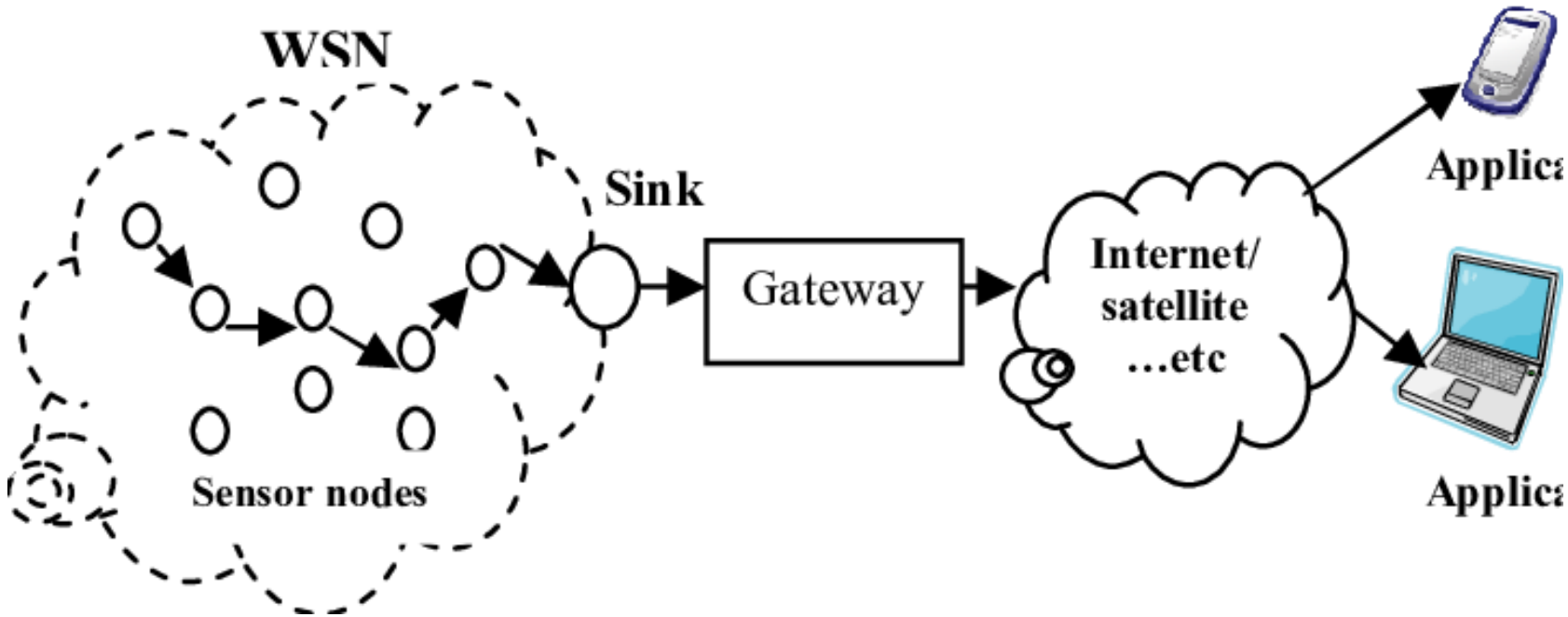


WSN, WSN NETWORK DESIGN FOR IOT:

A Wireless Sensor Network (WSN) is a crucial component in the Internet of Things (IoT) ecosystem, especially in industrial and environmental monitoring applications. WSNs consist of spatially distributed autonomous sensors that communicate wirelessly and collaborate to monitor physical or environmental conditions.



Wireless Sensor Network (WSN) design for IoT involves creating a wireless network of spatially distributed sensor nodes that communicate collaboratively to monitor physical conditions. This design encompasses choosing suitable topologies, selecting energy-efficient sensor nodes, implementing secure communication protocols, managing power effectively, and addressing factors such as scalability, fault tolerance, and regulatory compliance to enable reliable and efficient data transmission within the Internet of Things (IoT) ecosystem.



UNIT -02: COMPLETED