

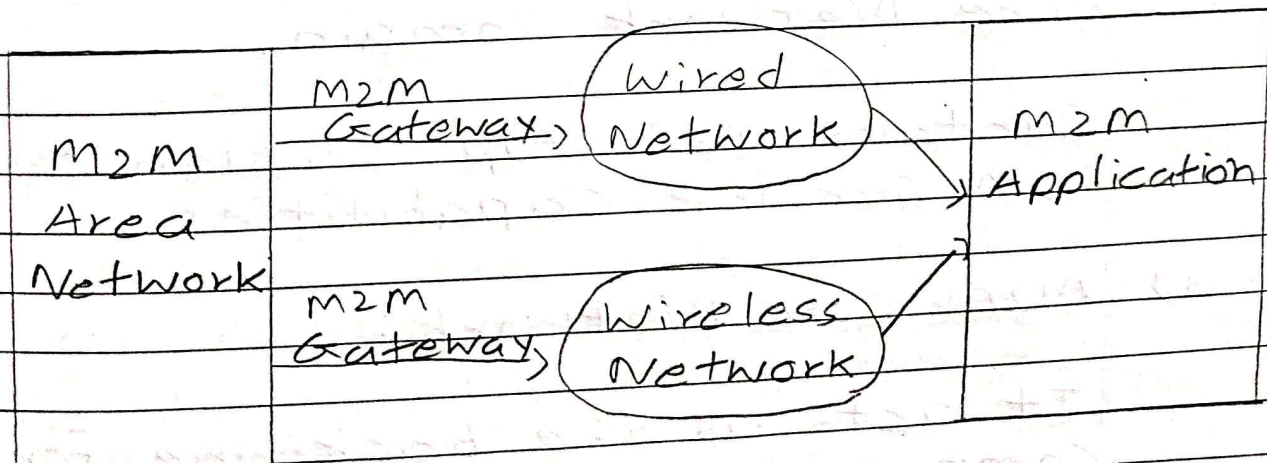
7 Explain characteristic and Application of M2M Communication, Also with its advantages and disadvantages.

=> M2M (Machine-to-Machine) refers to networking of machines for the purpose of remote monitoring, control and data exchange.

M2M Communication involves automated data exchange b/w devices without human intervention.

The high-level architecture combines Functional and topological views.

M2M Systems comprising of m2m area networks, communication network and application domain.



M2M Core Network

(A) M2M Area Network:

It is comprises of machines which have embedded hardware modules for sensing, actuation and communication.

The Layer consists of devices and sensors that communicate with each other.

Devices communicate wirelessly or through wired connections.

-> M2M Gateway: It collects data from devices and forwards it to the core network.

It connects M2M Devices in an M2M area Network to the core Network Domain.

Contains M2M Application and M2M service capabilities.

(B) M2M Core Network:

It acts as the backbone for communication, transmitting

data b/w devices and Application.

Two Types of networks are used:

- c.i) Wired Network (Routers, Switches)
- c.ii) Wireless Network (Cellular Towers, LPWAN, Wi-Fi)

The Core Network ensures reliable data transmission.

(c) M2M Application:

The Final destination of data where it is processed and analyzed.

These applications can be hosted on Servers or cloud platforms.

=> Characteristics of M2M Communication

- (1) Autonomous Communication: Devices exchanges data with minimal human intervention.
- (2) Scalability: Supports a large number of connected devices in an IoT ecosystem.

- (3) Remote Monitoring and Control:
Enables monitoring and controlling devices from distant locations.
- (4) Diverse Connectivity Options:
Supports wired and wireless technologies.
- (5) Data Transmission and Processing:
Collects and processes real-time data for decision-making.
- (6) Low Latency: Ensures quick data transmission and response time.
- (7) Security and Authentication:
Implement encryption and authentication mechanisms to prevent unauthorized access.

=> Advantages:

- (1) Automation and Efficiency: Reduces human intervention and improves operational efficiency.
- (2) Cost Savings: Lowers maintenance

costs with predictive analytics.

(3) Scalability: Easily integrates with existing IoT ecosystems.

(4) Enhanced Security: Uses encryption and authentication protocols to prevent unauthorized access.

(5) Real-time Decision Making: Enables AI-based decision-making for industry.

=> Disadvantages:

(1) Security Risks: Vulnerable to cyber threats if not properly secured.

(2) High Initial Cost

(3) Complexity in Integration

(4) Data Overload

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8 State the Difference b/w M2M and IoT.

=>

IoT

M2M

1

Uses Network-based connection with various communication types.

Uses point-to-point connection

2

Supports Cloud communication.

Supports point-to-point communication.

3

Uses internet protocol such as HTTP, FTP etc.

Uses traditional protocol and communication techniques.

4

Data is sharing b/w multiple application.

Data is shared only b/w the communicating parties.

5

Require internet connection for communication.

Does not depend on the internet.

- | | | |
|---|--|--|
| 6 | Connect Large numbers of device : wide scope | Limited scope for device |
| 7 | Supports Open API Integration | No support for Open APIs |
| 8 | Ex. Smart wearable, Big Data, Cloud etc. | Ex. Sensors, Data Transfer, Information, exchange etc. |

9 How is the industrial IoT different from IoT?

=> The Industrial IoT (IIoT) consists of multiple layers, each with specific function.

IIoT generates Large amounts of real-time data from industrial processes.

There are main 5 Layer or Component of IIoT.

(1) Perception Layer

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- (2) Network Layer
- (3) Processing Layer
- (4) Application Layer
- (5) Business Layer.

1 Perception Layer:

This Layer also known as Device and Sensor Layer which includes physical sensors and devices connected to network.

It Gathers data on parameter like temperature, air pressure, ~~Ex~~ Fluid levels etc.

2 Network Layer:

Network Layer also known as Transport Layer which responsible for transmitting the collected data for processing.

Ensures secure and reliable data transfer b/w sensors and processing units.

3 Processing Layer:

Processing Layer also known as Edge and cloud Computing Layer which extracts meaningful insights from raw data.

Uses AI and ML to process and analyze data.

4 Application Layer:

Application Layer also known as User Interface Layer which provides interaction b/w humans and processed data.

It includes dashboards for monitoring, controlling and reporting.

5 Business Layer:

This Layer also known as Decision-making Layer which transforms processed data into actionable business intelligence.

Helps decision-makers optimize processes and reduce costs.

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	ToT	IIoT
1	A Network of connected smart devices that communicate over the internet.	A Specialized sub set of ToT Focused on industry automation, monitoring.
2	Acceptable Latency in seconds.	Requires Ultra-low Latency.
3	Moderate Security Risks.	Higher Security Risk.
4	Generally Low-Cost and Consumer Friendly.	High investment required.
5	Fewer Regulation	Strict Regulation

70 What is SDN?

=> SDN stands For Software Defined Networking which is approach to network management that enables dynamic, efficient network configuration.

It improves network performance and monitoring by making network easier and more flexible to control.

=> SDN Architecture :

SDN Architecture consists of three main Layers :

C1) Application Layer

C2) Control Layer

C3) Infrastructure Layer.

1 Application Layer:

This Layer contains applications that interact with network.

It include Functionalities such as :

- Intrusion Detection system
- Firewalls
- Load Balancing services.

This application communicate with the control Layer using North bound APIs.

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Application Layer

N/W Application	N/W Application

Control Layer

Network Operating System

Infrastructure Layer

Simple Packet Forwarding Hardware

2 Control Layer:

The Control layer consists of the SDN controller which serves as the network's central intelligence.

It manages entire network from a central point.

Makes decisions about where and how data should be forwarded.

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The SDN Controller communicates with,

- Application Layer via Northbound APIs
- Infrastructure Layer via Southbound APIs.

3 Infrastructure Layer :

This Layer consists of physical and virtual network devices.

The data plane resides in this devices and performs the actual forwarding of packets based on rules set by the control Layer.

* IoT Value Chain :

=> The IoT Value chain refers to the Flow of data across different stages.

IoT value chain Focus on how data can be used and reused across multiple solution and industries.

There are main 5 stage :

1 Inputs (Raw Data Source) :

This is the 1st stage where data is collected from various sources.

- Sensors : Collects Data from the Physical environment.
- Open Data : Publicly available datasets.
- OSS / BSS : Used by mobile network for managing services.
- Corporate Databases

2 Production / Manufacture (Data Processing):

At This stage, Raw data is transformed into useful information.

Types of Processed Data:

ci) Asset Information

cii) Open Data sets

ciii) Network Information etc.

3 Processing (Data Integration and Analysis):

In this stage, Different types of data from the production phase are integrated and processed.

Removing errors, duplicates and inconsistencies from collected data.

4 Packaging (Data Representation and Visualization):

Once data is processed, it is formatted into understandable and useful forms for decision-making.

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Method of Packaging Data:

- ci) Reports and Dashboards
- cii) Real Time Alerts and Notifications,
- ciii) APIs and Data Services.

5 Distribution / Marketing:

At the Final stage, processed data is used for decision-making or sold as a product to other businesses.

* M2M Value Chain:

M2M value chain refer to the processes within a company that transform raw data into meaningful information.

=> Stages of M2M Value Chain:

1 Inputs:

Raw Data is collect by M2M devices such as temperature, location etc.

2 Production / Manufacture:

The stage where raw inputs undergo transformation to become part of the value chain.

M2M data is verified, filtered and tagged for authenticity and accuracy.

Inputs → Production → Processing

↓
Distribution and Marketing ← Packaging

3 Processing:

The Process of refining inputs into an actionable product.

M2M data From different devices is aggregated and analyzed to create valuable insights.

4 Packaging:

The Final preparation of the product for end-users, including

branding and Formatting

5 Distribution / Marketing:

The stage where the final product reaches its intended users.

m2m generated insights are utilized in decision making or predictive maintenance.