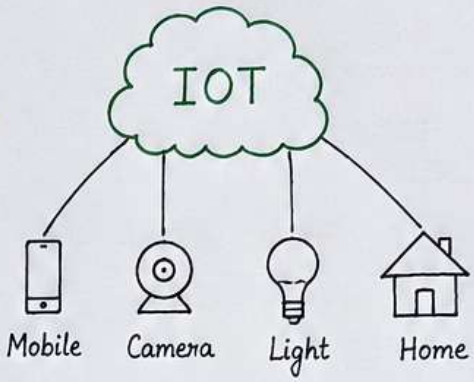
INTERNET OF THINGS (IOT)

★ 1. Introduction to IoT

→ IoT stands for Internet of Things.

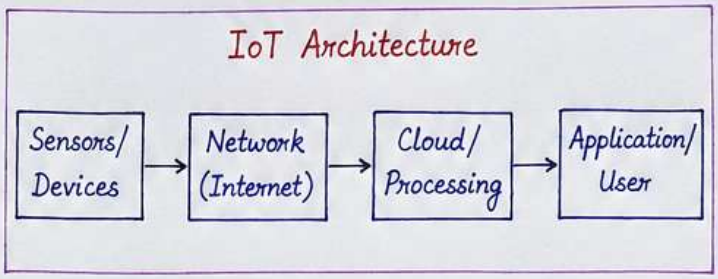
→ IoT is a network of physical devices embedded with sensors, software and other technologies to connect and exchange data with other devices and systems over the internet.

→ IoT enables objects to be sensed or controlled remotely across existing network infrastructure.



2. Components of IoT

1. Devices / Sensors – Collect data from environment.
2. Connectivity – Transmit data over the internet.
3. Data Processing – Process and analyze the data.
4. User Interface – Display data to the user / take action.



3. Characteristics of IoT

- Connectivity
- Things related services
- Heterogeneity
- Dynamic changes
- Enormous scale
- Interoperability
- Safety
- Security & Privacy

4. Applications of IoT

- Smart Home
- Smart City
- Smart Healthcare
- Smart Agriculture
- Industrial Automation
- Smart Transportation
- Smart Energy Management
- Environmental Monitoring
- Retail & Supply Chain
- Wearable Devices

IoT is used in many fields to make life easier, safer and more efficient. ☺

5. Advantages of IoT

- Remote monitoring and control
- Improved efficiency
- Real-time data and analytics
- Cost reduction
- Automation
- Better decision making
- Energy saving
- Increased productivity
- Enhanced customer experience

Remember: IoT connects things, data and people. ☆

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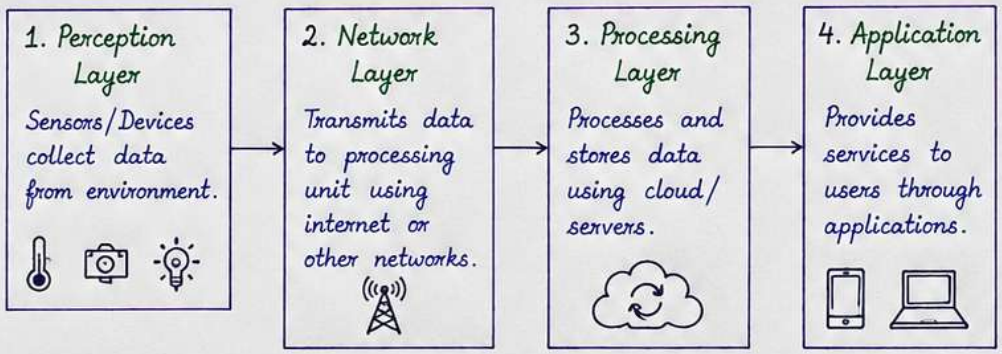
6. Disadvantages / Challenges of IoT

- Security and privacy concerns
- Dependence on internet connectivity
- Complexity in device management
- High initial cost of implementation
- Data storage and analysis challenges
- Interoperability issues
- Power consumption of devices
- Lack of standards in some areas
- Risk of data loss
- Maintenance and updates

Exam Tip:
Always write advantages and disadvantages in points. ☺

7. IoT Architecture (4 Layer Model)



Flow of Data in IoT

Sensors → Network → Processing → Application ↓ User

8. Communication Protocols in IoT

Protocol	Type	Used For	Features
MQTT	Messaging	IoT devices, telemetry	Lightweight, Publish-Subscribe, Low bandwidth
HTTP/HTTPS	Request-Response	Web based communication	Reliable, Secure (HTTPS)
CoAP	Request-Response	Low power IoT devices	Lightweight, Uses UDP
AMQP	Messaging	Enterprise applications	Reliable messaging protocol
XMPP	Messaging	Real-time communication	Presence, Instant messaging
DDS	Middleware	IoT, Real-time systems	High performance, Scalable

Remember:
MQTT is most popular protocol in IoT. ☆

9. Popular IoT Platforms

- AWS IoT – Amazon Web Services IoT platform.
- Microsoft Azure IoT – Microsoft cloud based IoT platform.
- Google Cloud IoT – Google's cloud platform for IoT.
- IBM Watson IoT – IBM's IoT platform for business solutions.
- ThingsBoard – Open source IoT platform.

These platforms provide

- ✓ Device management
- ✓ Data storage
- ✓ Data analytics
- ✓ Security
- ✓ Application development

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10. Sensors in IoT

Sensors are used to sense or measure physical parameters from the environment and convert them into data.

Common Sensors

Sensor	Function	Used In
1. Temperature Sensor	Measures temperature	Smart Home, Healthcare
2. Humidity Sensor	Measures humidity	Agriculture, Weather Station
3. Motion Sensor	Detects motion / movement	Security System, Automation
4. Light Sensor	Measures light intensity	Smart Lighting
5. Pressure Sensor	Measures pressure	Industrial, Weather
6. Gas Sensor	Detects harmful gases	Industries, Safety
7. Proximity Sensor	Detects nearby objects	Automation, Robotics
8. Sound Sensor	Detects sound level	Security, Monitoring

Exam Tip:
Remember different sensors and their applications. ☺

Key Point
Sensors are the eyes and ears of IoT. ☆

11. Actuators in IoT

Actuators are used to perform physical actions based on the commands received from the system.

Common Actuators

Actuator	Function	Used In
1. Motor	Produces motion	Robotics, Automation
2. Relay	Switches ON/OFF devices	Home Automation
3. Solenoid	Converts electrical energy into linear motion	Industrial Automation
4. Buzzer	Produces sound	Alarms, Alerts
5. LED	Produces light	Indicators, Displays

Remember:
Sensors collect data, Actuators perform action. ☺

Example
Temperature Sensor detects high temperature → Fan (Actuator) turns ON.

12. IoT Communication Technologies

1. Wi-Fi – High speed, short range, more power.
2. Bluetooth (BLE) – Low power, short range.
3. ZigBee – Low power, low data rate.
4. LoRaWAN – Long range, low power.
5. NB-IoT – Cellular based, wide coverage, low power.
6. LTE-M – Cellular based, better speed than NB-IoT.

Use
- Wi-Fi → High speed data
- BLE → Wearables, Health devices
- ZigBee → Industrial, Home Automation
- LoRaWAN → Smart City, Agriculture
- NB-IoT / LTE-M → Wide area IoT

13. IoT Data Flow

1. Data Collection → Sensors / Devices
2. Data Transmission → Network (Wi-Fi / Cellular / LoRa / ZigBee)
3. Data Processing → Cloud / Edge Processing
4. Application → User Application / Dashboard
5. Action → Actuator / Control

☆ This flow makes IoT system complete and useful.

Quick Revision:
Sense → Transmit → Process → Application → Action

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Date : __/__/__

TOP 100 ONE-LINE FACTS

1. IoT stands for Internet of Things.
2. IoT connects physical devices through the Internet.
3. Sensors collect data from the environment.
4. Actuators perform physical actions.
5. IoT enables Machine-to-Machine (M2M) communication.
6. Cloud computing stores and processes IoT data.
7. Edge computing processes data near the source.
8. Fog computing works between edge devices and the cloud.
9. MQTT is the most popular IoT messaging protocol.
10. MQTT follows the Publish-Subscribe model.
11. MQTT uses TCP.
12. CoAP is designed for constrained IoT devices.
13. CoAP uses UDP.
14. HTTP follows the Request-Response model.
15. HTTPS is the secure version of HTTP.
16. REST API is widely used in IoT.
17. JSON is the most common IoT data format.
18. XML is another IoT data format.
19. RFID stands for Radio Frequency Identification.
20. NFC stands for Near Field Communication.
21. NFC range is about 10 cm.
22. Bluetooth is a short-range wireless technology.
23. BLE means Bluetooth Low Energy.
24. ZigBee uses IEEE 802.15.4.
25. Wi-Fi uses IEEE 802.11.
26. LoRaWAN provides long-range communication.
27. NB-IoT is a cellular IoT technology.
28. LTE-M supports mobile IoT devices.
29. IPv4 uses 32-bit addresses.
30. IPv6 uses 128-bit addresses.
31. IPv6 supports billions of IoT devices.
32. MAC Address uniquely identifies a network interface.
33. IP Address identifies a device on a network.
34. DNS converts domain names into IP addresses.
35. DHCP automatically assigns IP addresses.
36. Gateway connects IoT devices to the Internet.
37. Router forwards packets between networks.
38. Switch forwards frames using MAC addresses.
39. Hub broadcasts data to all ports.
40. Firewall protects a network from attacks.
41. Encryption secures IoT data.
42. AES is a symmetric encryption algorithm.
43. RSA is an asymmetric encryption algorithm.
44. SSL/TLS provides secure communication.
45. Authentication verifies identity.
46. Authorization grants access rights.
47. CIA = Confidentiality, Integrity, Availability.
48. Malware includes viruses, worms and Trojans.
49. Ransomware encrypts files for ransom.
50. Phishing steals usernames and passwords.
51. Mirai is a famous IoT botnet.
52. Smart Home is a common IoT application.
53. Smart City improves urban services.
54. Smart Agriculture monitors crops.
55. Smart Healthcare enables remote patient monitoring.
56. Smart Grid manages electricity efficiently.
57. Smart Meter records energy consumption.
58. Industrial IoT is called IIoT.
59. Industry 4.0 is based on automation and IoT.
60. Wearable devices are IoT devices.
61. Smart Watch is an IoT device.
62. Temperature Sensor measures temperature.
63. Humidity Sensor measures moisture.
64. Pressure Sensor measures pressure.
65. Motion Sensor detects movement.
66. Proximity Sensor detects nearby objects.
67. Gas Sensor detects harmful gases.
68. Light Sensor measures light intensity.
69. Accelerometer measures acceleration.
70. Gyroscope measures angular velocity.
71. GPS provides location information.
72. Arduino is a popular microcontroller board.
73. Raspberry Pi is a single-board computer.
74. ESP8266 has built-in Wi-Fi.
75. ESP32 supports Wi-Fi and Bluetooth.
76. Battery life is critical for IoT devices.
77. Low power consumption is an important IoT feature.
78. Real-time monitoring is a major advantage of IoT.
79. Predictive maintenance reduces equipment failures.
80. Digital Twin is a virtual model of a physical object.
81. AI improves IoT decision-making.
82. Machine Learning analyzes IoT data.
83. Big Data is generated by IoT devices.
84. Data Analytics extracts useful information.
85. Scalability is essential for IoT systems.
86. Interoperability means devices can work together.
87. Security is the biggest challenge in IoT.
88. Privacy is another major concern.
89. IoT reduces manual work.
90. IoT increases automation.
91. IoT improves efficiency.
92. IoT enables remote control.
93. IoT reduces operational cost.
94. IoT supports real-time decision making.
95. AWS IoT is Amazon's IoT platform.
96. Microsoft Azure IoT is Microsoft's IoT platform.
97. Google Cloud IoT supports IoT applications.
98. IBM Watson IoT is an enterprise IoT platform.
99. ThingsBoard is an open-source IoT platform.
100. IoT Data Flow: Sensors → Network → Processing (Edge/Cloud) → Application → Actuator/User.