

IoT Architecture and Communication Protocols

IoT (Internet of Things) architecture defines the structure and layers that enable devices to connect, communicate, and process data efficiently. It ensures scalability, interoperability, and seamless integration of diverse devices. Typical IoT Architecture (4 Layers): 1. Perception Layer: Physical devices and sensors that collect real-world data (e.g., temperature, motion, GPS). 2. Network Layer: Responsible for transmitting data using wired/wireless networks (Wi-Fi, Bluetooth, Zigbee, 5G). 3. Edge/Processing Layer: Performs data preprocessing, storage, and analysis using gateways or edge computing devices. 4. Application Layer: Provides services to end-users through apps, dashboards, and smart systems. IoT Communication Protocols: - MQTT (Message Queuing Telemetry Transport): Lightweight protocol for low-bandwidth devices, widely used in IoT. - CoAP (Constrained Application Protocol): Designed for simple, low-power devices, operates over UDP. - HTTP/HTTPS: Standard web communication, more resource-intensive. - AMQP (Advanced Message Queuing Protocol): Ensures reliable communication between distributed systems. - Bluetooth Low Energy (BLE): Energy-efficient short-range protocol. - Zigbee/Z-Wave: Wireless mesh protocols for home automation. - 5G/LPWAN (NB-IoT, LoRaWAN): Enable large-scale IoT deployments with wide coverage. Conclusion: IoT architecture provides the foundation for connecting billions of devices, while communication protocols ensure reliable and efficient data transfer. The choice of protocol depends on application needs such as power efficiency, range, latency, and scalability.