

Technical stack combinations for the development:

1. LoRaWAN + MQTT + AWS IoT + Cloud Storage:

- LoRaWAN for long-range, low-power wireless communication.
- MQTT as the messaging protocol for lightweight communication.
- AWS IoT for device management, data processing, and analytics.
- Cloud storage for storing and retrieving IoT data.

2. Bluetooth Low Energy (BLE) + MQTT + Azure IoT + Edge Computing:

- BLE for short-range communication with low power consumption.
- MQTT for efficient and reliable messaging.
- Azure IoT for device management, data processing, and edge computing capabilities.
- Edge computing to perform real-time analytics and decision-making at the network edge.

3. Thread + CoAP + Google Cloud IoT + Cloud Functions:

- Thread as a low-power, mesh networking protocol for IoT devices.
- CoAP (Constrained Application Protocol) for resource-constrained devices and efficient communication.
- Google Cloud IoT for device registration, management, and integration with Google Cloud services.
- Cloud Functions to trigger serverless functions and perform actions based on IoT data.

4. NB-IoT + MQTT + IBM Watson IoT Platform + Blockchain (not low cost):

- NB-IoT (Narrowband IoT) for wide-area coverage and low-power communication.
- MQTT for lightweight messaging between devices and the cloud.
- IBM Watson IoT Platform for device management, data visualization, and analytics.
- Blockchain for secure and transparent transaction recording and smart contract execution.

Comparative analysis of technical stacks:

Technical Stack Combination	Communication Protocol	Cloud Platform	Edge Computing	Data Storage	Key Features and Benefits
LoRaWAN + MQTT + AWS	LoRaWAN, MQTT	AWS IoT	Not applicable	Cloud storage	- Long-range, low-power communication,

Technical Stack Combination	Communication Protocol	Cloud Platform	Edge Computing	Data Storage	Key Features and Benefits
IoT + Cloud Storage					lightweight messaging protocol, device management, data processing, and analytics with AWS IoT, scalable and reliable cloud storage
Bluetooth Low Energy (BLE) + MQTT + Azure IoT + Edge Computing	BLE, MQTT	Azure IoT	Edge computing	Not applicable	- Short-range communication with low power consumption, efficient and reliable messaging protocol, device management, data processing, and edge computing with Azure IoT, real-time analytics and decision-making at the network edge
Thread + CoAP + Google Cloud	Thread, CoAP	Google Cloud IoT	Not applicable	Cloud storage	- Low-power, mesh networking protocol for IoT

Technical Stack Combination	Communication Protocol	Cloud Platform	Edge Computing	Data Storage	Key Features and Benefits
IoT + Cloud Functions					devices, efficient communication with resource-constrained devices, device management, integration with Google Cloud services, serverless functions for triggering actions based on IoT data
NB-IoT + MQTT + IBM Watson IoT Platform + Blockchain	NB-IoT, MQTT	IBM Watson IoT Platform	Not applicable	Blockchain	- Wide-area coverage and low-power communication, lightweight messaging protocol, device management, data visualization, and analytics with IBM Watson IoT Platform, secure and transparent transaction recording with blockchain