Gateway and Backhaul Sublayer & Communication Network Layer in IoT

1. Gateway and Backhaul Sublayer in CoDE IoT Functional Stack

Definition:

The Gateway and Backhaul sublayer is a part of Layer 2: Communication Network Layer in the CoDE IoT functional stack.

It connects the local IoT environment (devices and sensors) to the global internet or cloud servers.

Key Components:

a) IoT Gateway:

- A hardware/software component placed between IoT devices and the internet.
- Acts as a bridge between the device layer and cloud/network services.
- Performs:
  - Protocol conversion (e.g., Zigbee to IP)
  - Data filtering/aggregation
  - Local processing to reduce cloud load
  - Security tasks like encryption and authentication

b) Backhaul Network:

- The communication link between the gateway and cloud/data center.
- Enables long-range and high-speed communication.
- Technologies include:
  - 4G/5G cellular networks
  - Fiber-optic cables
  - Wi-Fi/Ethernet
  - Satellite communication

Working:

1. Sensors/devices collect data (e.g., temperature, motion).
2. Data is transmitted via short-range protocols (e.g., Zigbee, BLE) to the gateway.

3. The gateway processes, formats, and may filter the data.

4. It sends the processed data via the backhaul network (like 5G or fiber) to the cloud.

5. Data is then used in applications like monitoring, analytics, automation, etc.

Functions:

- Interfacing with heterogeneous IoT devices
- Converting data into standard formats
- Secure and reliable communication to cloud
- Local decision-making support

2. Communication Network Layer in CoDE IoT Functional Stack

Definition:

This is Layer 2 in the CoDE IoT functional stack. It enables communication between:

- IoT devices
- Gateways
- Cloud/server infrastructure

It ensures end-to-end connectivity in IoT systems.

Sub-layers:

a) Device Access Sublayer:

- Manages local communication between sensors/actuators and gateways.
- Uses short-range, low-power protocols:
  - Zigbee
  - LoRa
  - Bluetooth Low Energy (BLE)
  - Wi-Fi
  - NB-IoT

b) Gateway and Backhaul Sublayer:

- Handles long-range communication from the gateway to the cloud.
- Uses 4G/5G, satellite, fiber, etc.

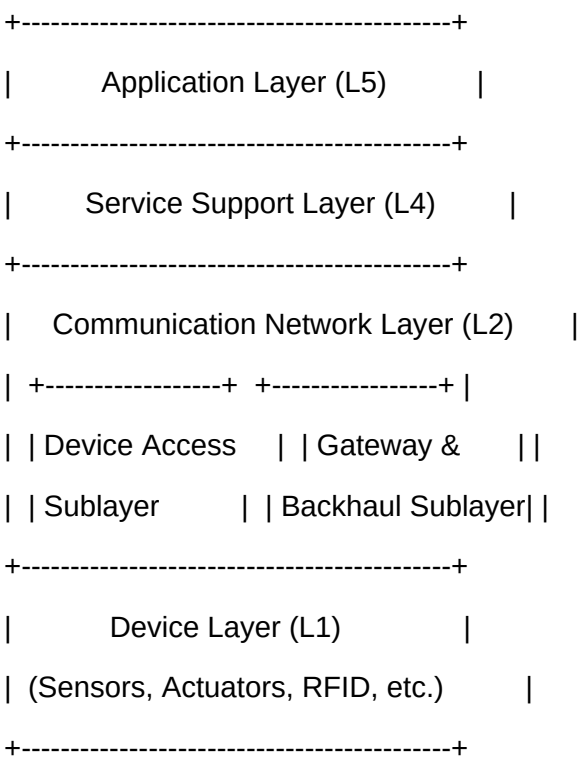
Working:

1. Data is generated by IoT devices.
2. Device Access sublayer sends it to gateways.
3. Gateway and Backhaul sublayer sends it to the cloud.
4. Cloud services analyze or respond back with commands.
5. Response is sent back through the same communication path.

Functions:

- Facilitates secure, efficient data flow
- Ensures interoperability among different devices/networks
- Manages protocol translation, QoS, and latency control
- Provides mobility and scalability for large networks

Diagram: CoDE IoT Functional Stack with Communication Network Layer



Conclusion:

The Communication Network Layer, especially the Gateway and Backhaul sublayer, is essential for connecting low-power

IoT devices to high-speed internet infrastructure. It supports:

- Interfacing
- Protocol handling
- Real-time communication
- Scalability

Together, they form the backbone of any functional IoT system by ensuring reliable data transmission from physical
devices to cloud-based applications.