A Brief Introduction to IoT gateway

Contents

Introduction

divided into three parts in IoT gateway

- Sensing domain, Network domain, Application domain
- **Sensing domain**
  - Interact and communicate 'things'
  - Consist of many things information and to realize information of physical target
  - Using Wireless sensor network(WSN), RFID, FieldBus, Barcode, Zigbee
  - Provide network domain with valuable
  - Obstacle : Low power, low cost, protocol lightweight

- **Network domain**
  - Evolved communication infrastructure
    - PSTN, 2G, 3G, LTE, Satellite
  - Main roles : to transfer the data collected from sensing domain to remote destination

Introduction

- **Application domain**
  - Take responsibility for Data processing and services
  - Data from transmission layer is handled
  - various services provide to user

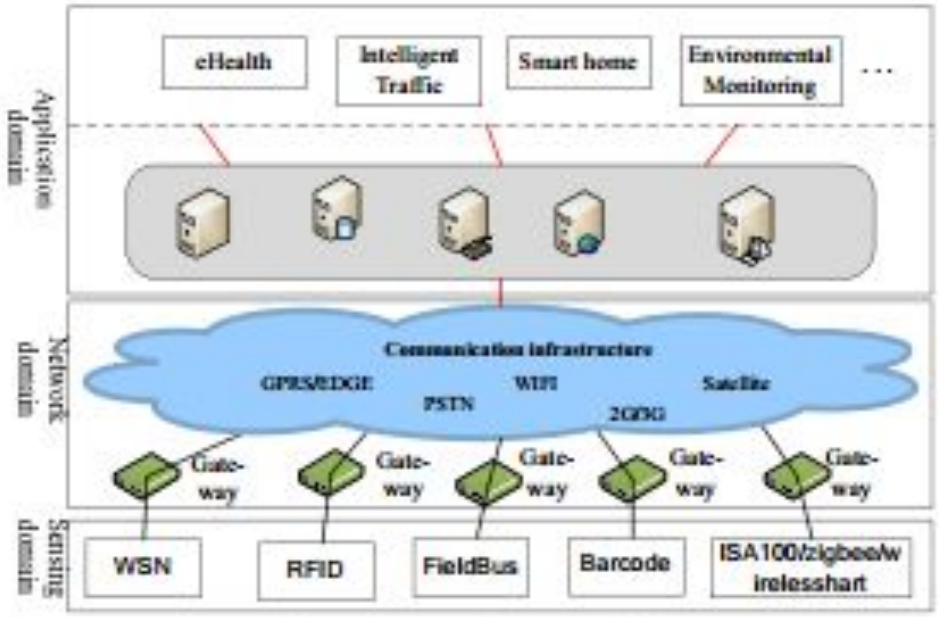

Figure 1 Three domains of IoT architecture

Three sensing domain network

PAN Network

- Personal area network
- Interacted sensing devices around the person
- Used smart phone, laptop, customized device
- Acted as the IoT gateway, control signaling, and data transmitted the IoT gateway
- A wired connect using USB/Fire wire
- A wireless connect using IrDA, Bluetooth, Wireless USB, ZigBee
- IoT gateway usually registers in the backend servers

Three sensing domain network

Vehicle network

- Two type of vehicle communication
  - Inside a vehicle
  - From/to vehicle
- Vehicle IoT gateway collect information surrounding ‘things’
  - road,rail,..etc
- Radio Frequency Identification technology
  - Improved vehicle logistics quality control, tracking
- Dedicated Short Range Communication
  - The possibility of higher bit rates
  - Reduce the possibility of interference with other equipment
- Intelligent Transportation Systems
  - It will be improved vehicle safety service and traffic management

Three sensing domain network

Home network

- Constructed with sensor, micro actuators, information home appliances etc..
- Home IoT Gateway interconnected multiple smart devices together
  - Shared resources, information
  - Integrate several common network protocols
  - Supports the intercommunication among the equipment with different network protocols
  - Control in-home smart equipment
- Contact external networks
  - Need to access from IoT Gateway to 2G/3G/mobile communication network modules
  - Can be managed smart things everywhere

Common features of IoT gateway

Features of IoT gateway

- Bridging the communication between sensing domain and network domain
- It can be quite different from application to application
- Common form of IoT gateway

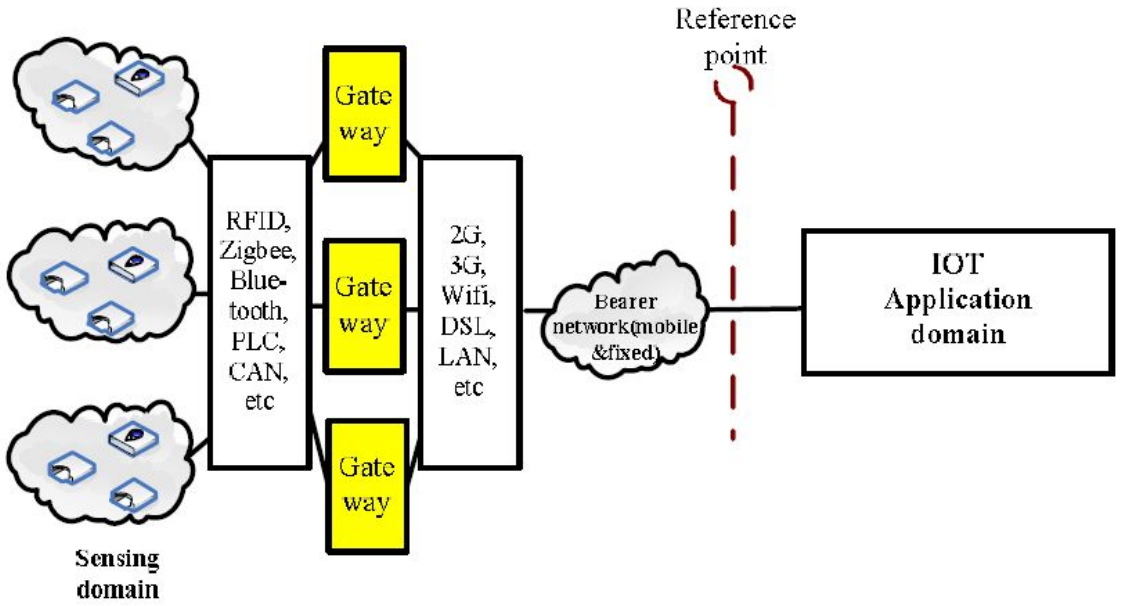

Figure 2 IoT gateways in the whole IoT infrastructure

Common features of IoT gateway

Features of IoT gateway

- **Multiple interfaces**
  - Connected to a IoT gateway through technologies
    - Zigbee
    - Bluetooth
    - Wifi
    - CAN–Controller area network
  - Can choice to connect to the public network
    - Kind of PSTN, 2G/3G, LTE..etc
  - Gateway should support depends on related application requirements, operation strategies and implement solutions

- **Protocol conversion**
  - IoT gateway need execute protocol conversion
  - Need to communicated between different sensing domain protocol
    - Occur communicate sensing domain protocol to network domain protocol

Common features of IoT gateway

Features of IoT gateway

- **Manageability**
  - Managed IoT gateway by itself
  - Back-end IoT server provide information
    - Subscription
    - Authority
    - Status
    - Mobility..etc
  - **IoT gateway have abilities to manage 'smart thing'**
    - Identify
    - Control
    - Diagnose
    - Configure
- **IoT gateway goal** : to bridge various sensing domain networks with public communication network or internet

Reference model of IoT gateway

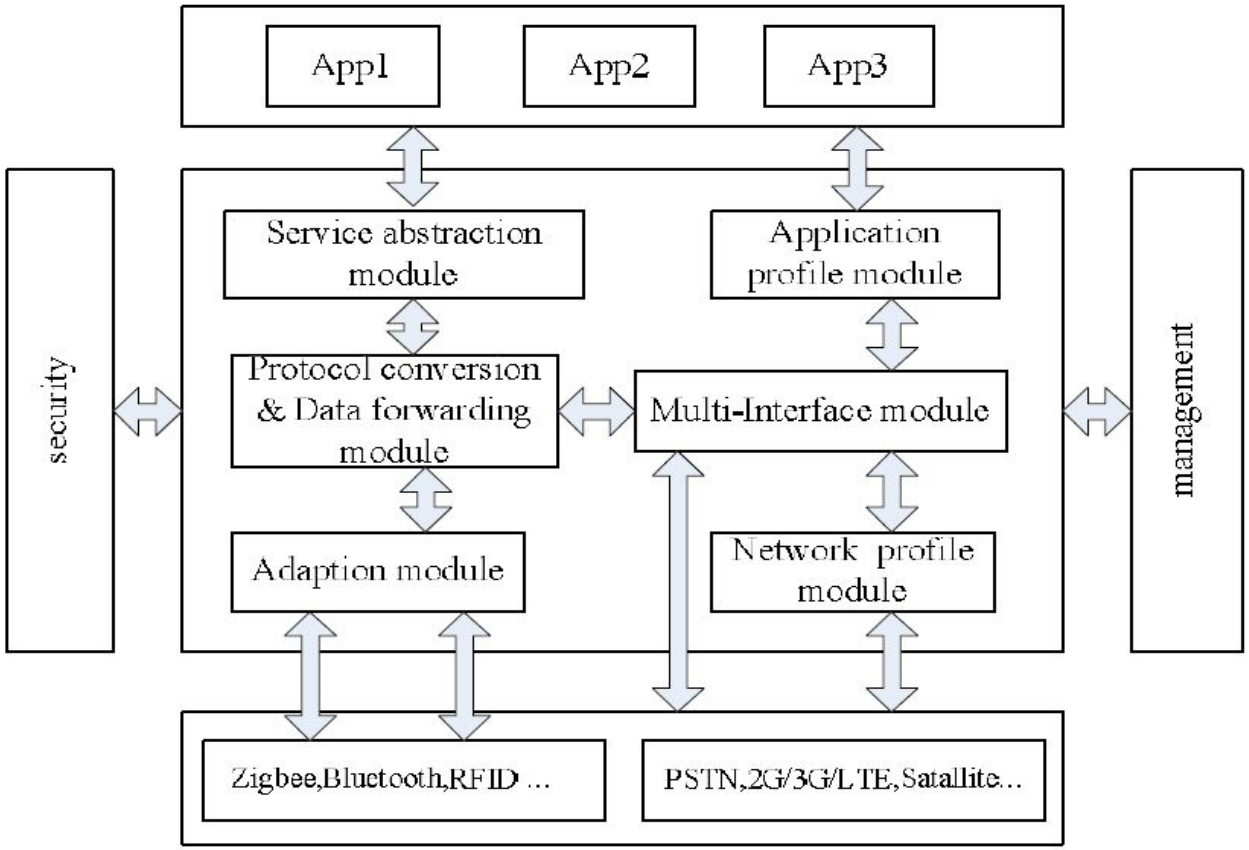

Figure 3 Reference model of IoT gateway

Reference model of IoT gateway

- **Service abstraction module**
  - Address fragmentation of IoT applications
  - Several functions
    - Uniform interfaces for service providers to simply application development
    - IoT application developers do not need deep understanding of underlying technologies
    - Enables underlying networks to use IoT optimization

- **IoT Gateway system use short-distance wireless communication protocol**
  - Zigbee, Bluetooth
- **Adaption module**
  - Focus on adaption the packet size of two different networks, address resolution
  - Eg. IPv6 packet transmit IEEE 802.15.4 networks

Reference model of IoT gateway

- **Protocol conversion & data forwarding module**
  - Interact with service abstraction module, adaption module, multi-interfaces module
  - Analyzed and repackaged the sensing data
    - Based on short-distance communication protocols
  - Capsulated and send data based on telecommunication protocols
  - Transfer data from one network to another network correctly

- **Application profile module and network profile module**
  - Provided contexts to Multi-Interfaces module
  - Helped Multi-Interfaces module can decision to use network interface

Reference model of IoT gateway

- **Application profile module**
  - Provided application level information
  - Can watch the type and number of application currently running

- **Security and Management**
  - based on ICT system
  - Security provide access control, data integrity, privacy protections
  - Management provide management
    - Network
    - power
    - fault
    - authority
    - status
    - mobility

Conclusion

- IoT communication is quite different from the traditional human to human communication using internet infrastructure
- Prime problem
  - Integrated kinds of sensing networks and telecommunication networks and Internet
  - Using IoT gateway is key to solve intergration