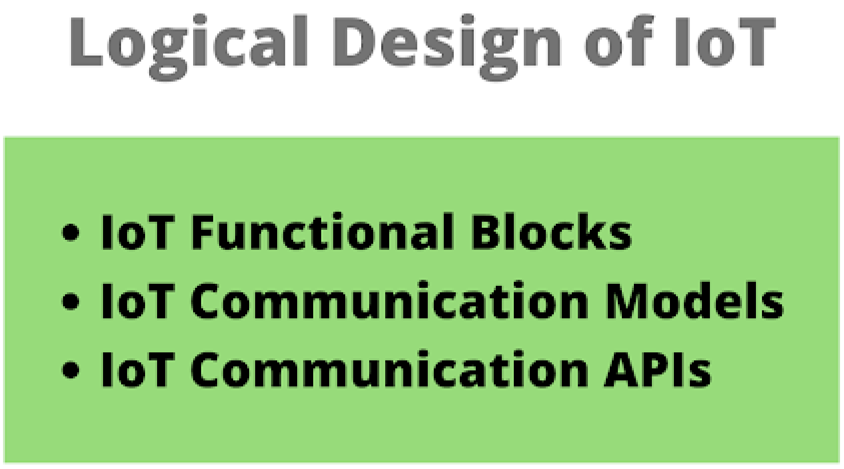
Logical Design of IoT

The logical design of an **IoT** system refers to an abstract representation of entities and processes without going into the low-level specifies of implementation. it uses **Functional Blocks**, **Communication Models**, and **Communication APIs** to implement a system.

But before you learn about the logical design of IoT systems you need to know a little bit about the physical design of IoT.



Logical Design of IoT

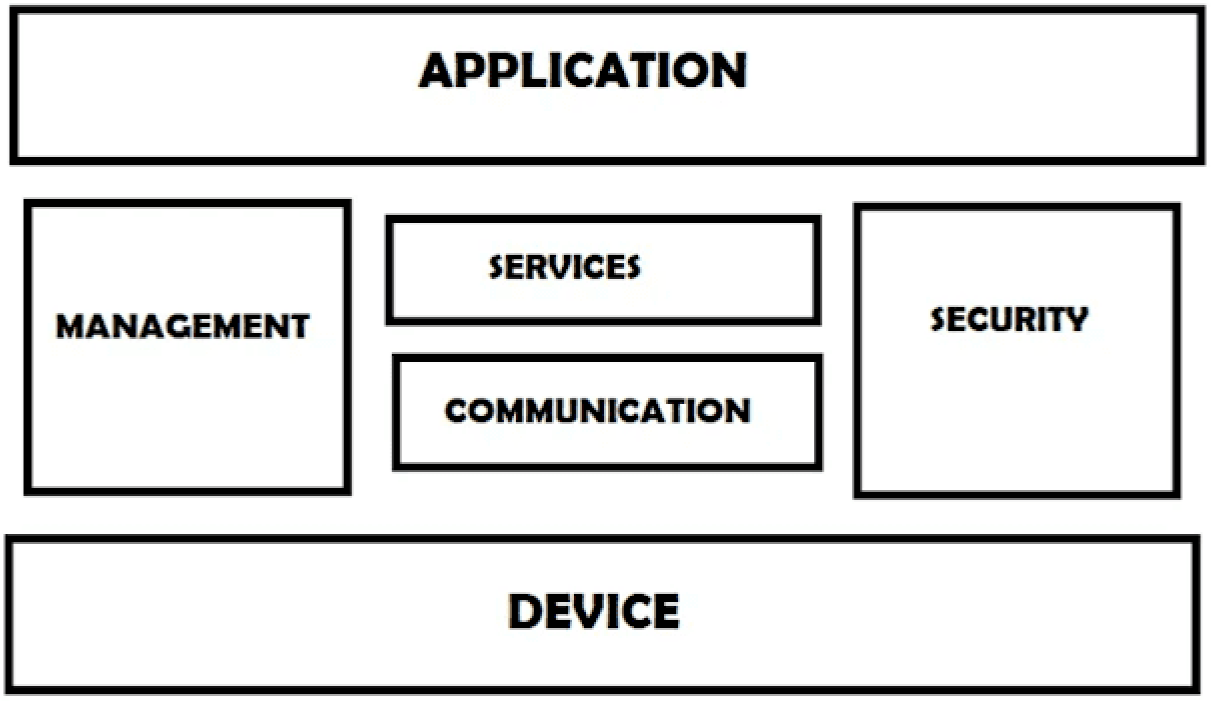
- IoT Functional Blocks
- IoT Communication Models
- IoT Communication APIs

Logical Design of Internet of Things(IoT)

1. IoT Functional Blocks
2. IoT Communication Models
3. IoT Communication APIs

IoT Functional blocks

An IoT system consists of a number of functional blocks like Devices, services, communication, security, and application that provide the capability for sensing, actuation, identification, communication, and management.



These functional blocks consist of devices that provide monitoring control functions, handle communication between host and server, manage the transfer of data, secure the system using authentication and other functions, and interface to control and monitor various terms.

Application

It is an interface that provides a control system that use by users to view the status and analyze of system.

Management

This functional block provides various functions that are used to manage an IoT system.

Services

This functional block provides some services like monitoring and controlling a device and publishing and deleting the data and restoring the system.

Communication

This block handles the communication between the client and the cloud-based server and sends/receives the data using protocols.

Security

This block is used to secure an IoT system using some functions like authorization, data security, authentication, 2-step verification, etc.

Device

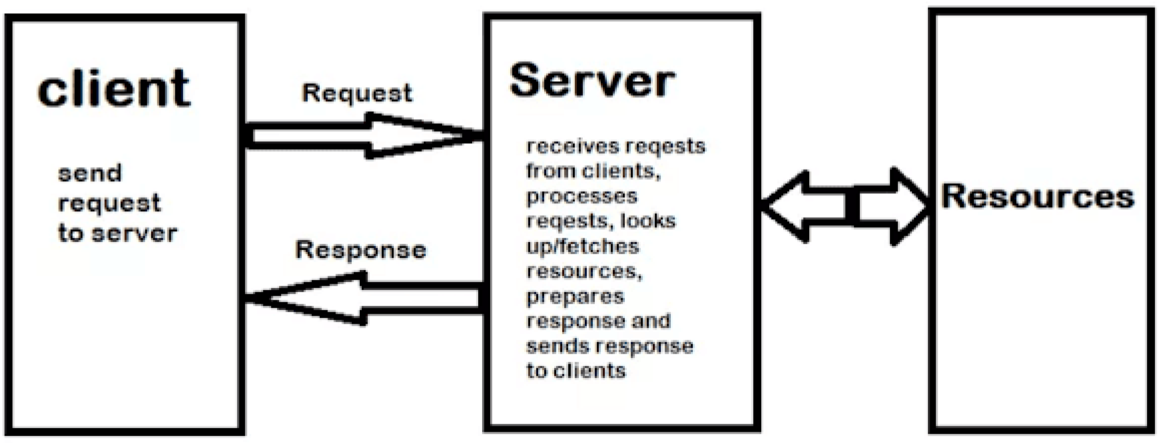
These devices are used to provide sensing and monitoring control functions that collect data from the outer environment.

IoT Communication Models

There are several different types of models available in an IoT system that is used to communicate between the system and server like the request-response model, publish-subscribe model, push-pull model, exclusive pair model, etc.

Request-Response Communication Model

This model is a communication model in which a client sends the request for data to the server and the server responds according to the request. when a server receives a request it fetches the data, retrieves the resources and prepares the response, and then sends the data back to the client.


client
send request to server
Request
Response
Server
receives reqests from clients, processes reqests, looks up/fetches resources, prepares response and sends response to clients
Resources
Request-Response Communication Model

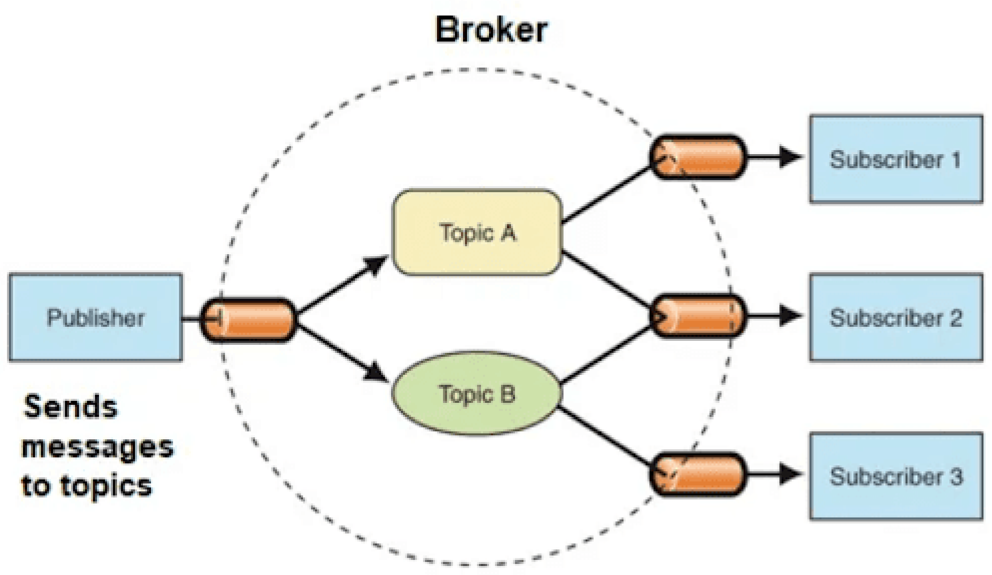
In simple terms, we can say that in the request-response model server send the response of equivalent to the request of the client. in this model, HTTP works as a request-response protocol between a client and server.

Example

When we search a query on a browser then the browser submits an HTTP request to the server and then the server returns a response to the browser(client).

Publish-Subscribe Communication Model

In this communication model, we have a broker between publisher and consumer. here publishers are the source of data but they are not aware of consumers. they send the data managed by the brokers and when a consumer subscribes to a topic that is managed by the broker and when the broker receives data from the publisher it sends the data to all the subscribed consumers.

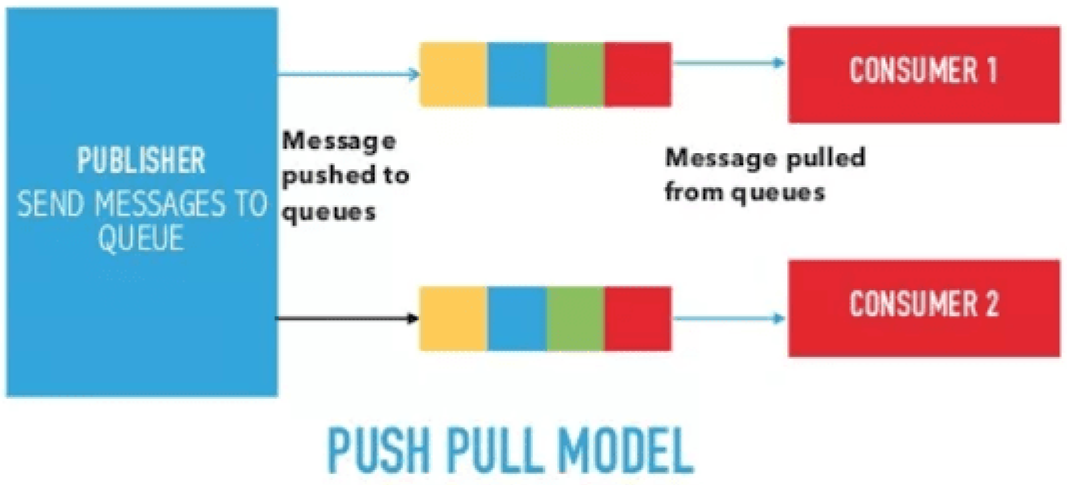


Example

On the website many times we subscribed to their newsletters using our email address. these email addresses are managed by some third-party services and when a new article is published on the website it is directly sent to the broker and then the broker sends these new data or posts to all the subscribers.

Push-Pull Communication Model

It is a communication model in which the data push by the producers in a queue and the consumers pull the data from the queues. here also producers are not aware of the consumers.

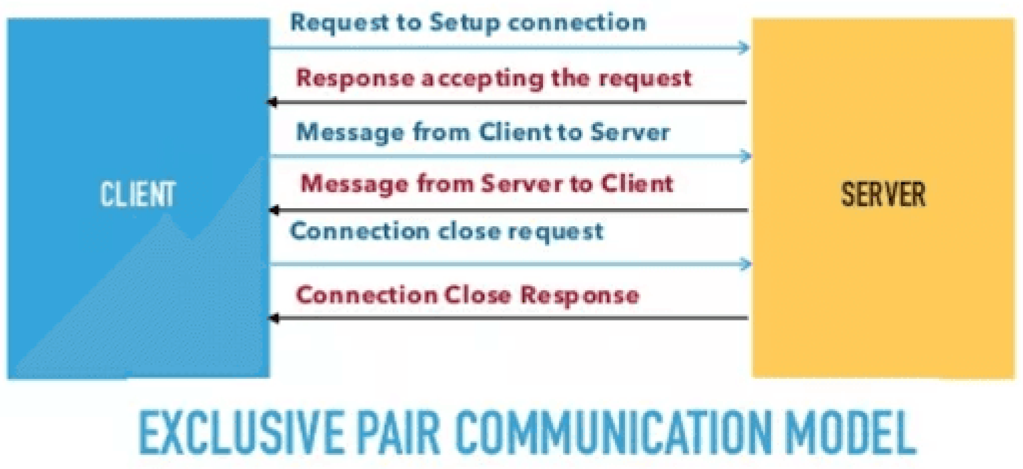


Example

When we visit a website we saw a number of posts that are published in a queue and according to our requirements, we click on a post and start reading it.

Exclusive Pair Communication Model

It is a bidirectional fully duplex communication model that uses a persistent connection between the client and server. here first set up a connection between the client and the server and remain open until the client sends a close connection request to the server.


Request to Setup connection
Response accepting the request
Message from Client to Server
Message from Server to Client
Connection close request
Connection Close Response
CLIENT
SERVER
EXCLUSIVE PAIR COMMUNICATION MODEL

IoT communication APIs

These APIs like REST and WebSocket are used to communicate between the server and system in IoT.

REST-based communication APIs

Representational state transfer(REST) API uses a set of architectural principles that used to design web services. these APIs focus on the systems' resources that how resource states are transferred using the request-response communication model. this API uses some architectural constraints.

Client-server

Here the client is not aware of the storage of data because it is concerned about the server and similarly the server should not be concerned about the user interface because it is a concern of the client. and this separation is needed for independent development and updating of server and client. no matter how the client is using the response of the server and no matter how the server is using the request of the client.

Stateless

It means each request from the client to the server must contain all the necessary information to understand by the server. because if the server can't understand the request of the client then it can't fetch the request data in a proper manner.

Cacheable

In response, if the cache constraints are given then a client can reuse that response in a later request. it improves the efficiency and scalability of the system without loading the extra data.

A RESTful web APIs is implemented using HTTP and REST principles.

WebSocket based communication API

This type of API allows bi-directional full-duplex communication between server and client using the exclusive pair communication model. this API uses full-duplex communication so it does not require a new connection setup every time when it requests new data. WebSocket API begins with a connection setup between the server and client and if the WebSocket is supported by the server then it responds back to the client with the successful response after the setup of a connection server and the client can send data to each other in full-duplex mode.

this type of API reduces the traffic and latency of data and makes sure that each time when we request new data it cannot terminate the request.