celluar IoT

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INTRODUCTION

- Cellular IoT uses cellular networks to connect physical devices to the Internet.

- same cell towers that provide service to your smartphone.

- connect heavy machinery, security systems, hospital equipment, asset tracking systems, and billions of other devices to the internet.

EVOLUTION OF NETWORK & BAND SPECIFICATION

02

2G

- Frequency: 900 MHz
- Bandwidth: 25 MHz
- Internet service: narrowband
- Application: text msg, picture & multimedia

4G

- Frequency: 2300 MHz
- Bandwidth: 100 MHz
- Internet service: Ultra band
- Application: High-speed data streaming, wearable device

2001

2018

1993

3G

- Frequency: 2100 MHz
- Bandwidth: 25 MHz
- Internet service: Broadband
- Application: video streaming, GPS

2009

5G

- Frequency: 24 GHz
- Bandwidth: 30 GHz to 300 GHz
- Internet service: wireless WWW
- Application: High resolutions streaming, medical procedures
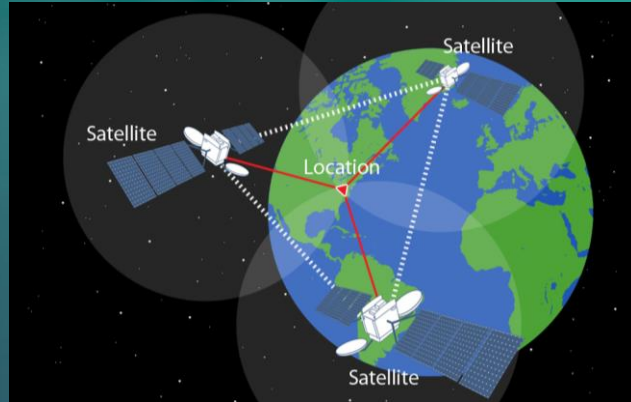
03 — HOW GPS WORKS

GPS (Global Positioning System)

A global positioning system (GPS) is a network of satellites and receiving devices used to determine the location of something (any device with GPS capability) on Earth.
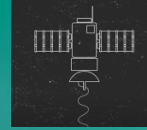
Does Internet data or cellular network is required to get GPS coordinates?

NO

HOW DOES THE GPS (Global Positioning System) WORK?

Utilize the 3 satellites to get an accurate position.
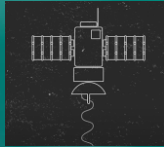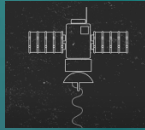
Satellites always transmit the radio signal towards the Earth.
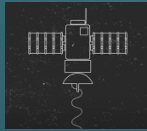
The fourth one to get Elevation.

Due to the built-in receiver, they are capable to receive this signal and calculate the distance depending on the time period.

Has a Built-in GPS receiver

HARDWARE SPECIFICATIONS & ESP-IDF CODE FLOW

04

HARDWARE SPECIFICATIONS

Module Name:
A7672S

- LTE Cat 1 Module.
- 10 Mbps downlink.
- 5 Mbps uplink.
- support USB driver for Windows, Linux & Android.
- Support BLE.
- support TCP/IP protocol.
- Support Industrial standard interfaces such as UART, USB, I2C & GPIO.
- FOTA.
- Supply voltage: 3.4v to 4.2v.

ANTENNA REQUIREMENT
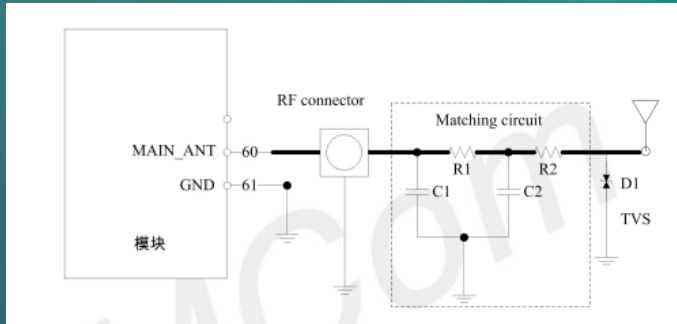
Passive antenna
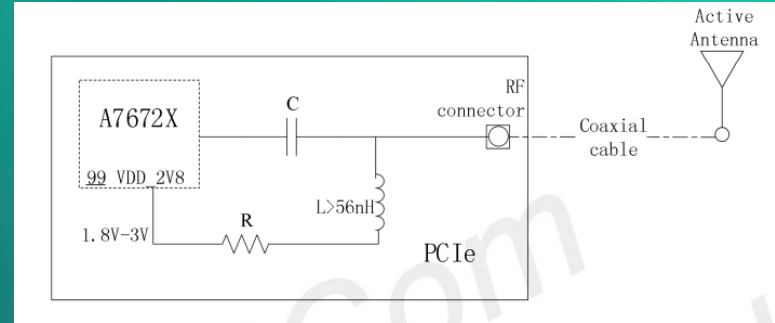
Active antenna = passive antenna + amplifier circuit

GSM/LTE Requirement:

Gain	> -3dBi (Avg)
Input impedance	50 ohm
Efficiency	> 50 %
Maximum input power	50W

SIMCOM INTERFACING WITH ESP32

Convert 1.8V to 3.3V

RX ← Level shifter ← TX

TX → Level shifter → RX

Convert 3.3V to 1.8V

ESP32 UART
works on 3.3V

SIMCOM UART
works on 1.8V
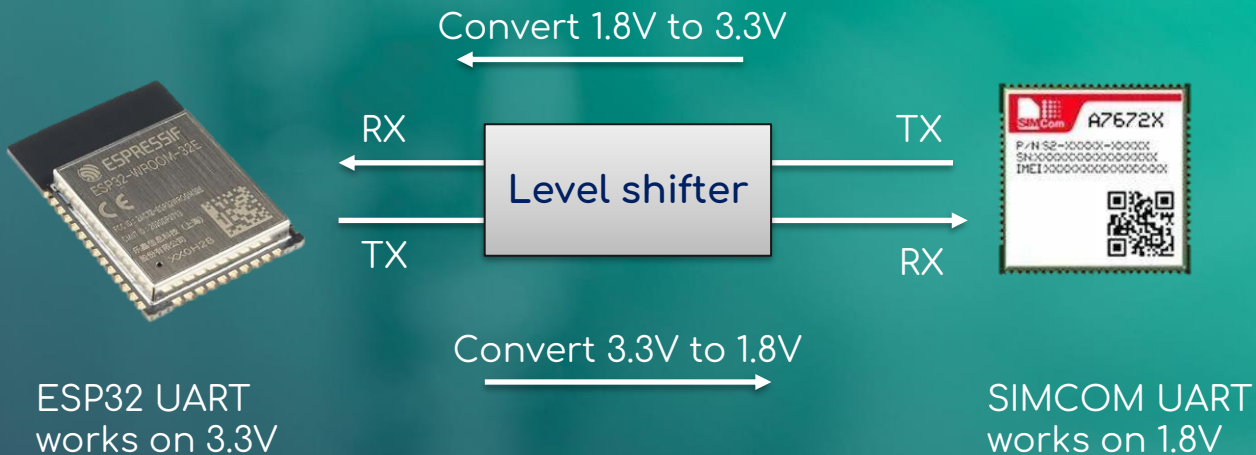
ROLE OF APN IN NETWORK?

- APN stands for Access Point Name.

- The APN is used to find the right IP address that the device should be identified with on the network, determine if a private network is needed, and choose the correct security settings that should be used.

- Example: Vodafone (M2MISAFE).

ESP-IDF CODE FLOW
(AT commands required)

```
┌──────────────┐      ┌─────────────────────┐      ┌──────────────┐      ┌──────────────────────┐
│ Check SIM    │ ───> │ Configure the       │ ───> │ Configure    │ ───> │ Take Time from SNTP  │
│ Status?      │      │ Network             │      │ the APN      │      │ server & write the   │
│              │      │ (Home or Roaming)   │      │              │      │ value to RTC         │
└──────────────┘      └─────────────────────┘      └──────────────┘      └──────────────────────┘
```
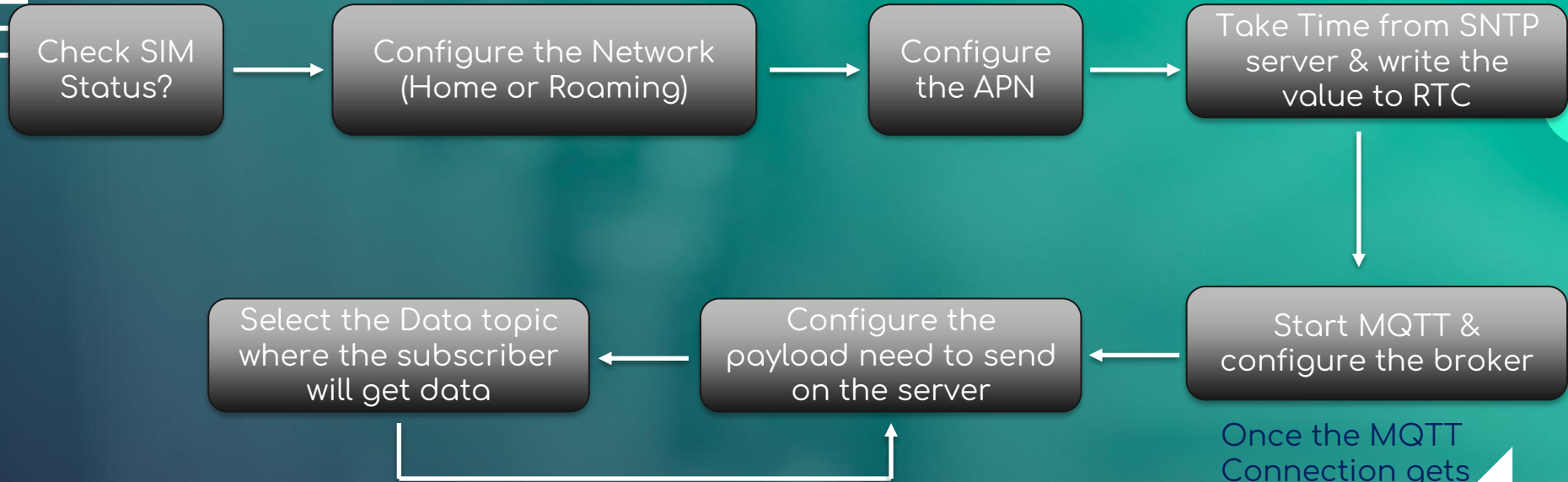
```
┌────────────────────┐      ┌─────────────────────┐      ┌──────────────────────┐
│ Select the Data    │ <─── │ Configure the       │ <─── │ Start MQTT &         │
│ topic where the    │      │ payload need to send│      │ configure the broker │
│ subscriber will    │      │ on the server       │      │                      │
│ get data           │      │                     │      │                      │
└────────────────────┘      └─────────────────────┘      └──────────────────────┘
```

Once the MQTT Connection gets established, will start another loop for just data posting

05

ADVANTAGES

ADVANTAGES

- Global coverage.

- No need to build additional infrastructure.

- Built-in authentication (each sim card has a unique chip ID)

- Secure connectivity.

CONCLUSION

- Make it suitable for IoT Applications.

Thanks!

Do you have any questions?
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