Djillali Liabes University of Sidi Bel Abbes Faculty of Exact Sciences

Department of Computer Sciences

WSN'S MONITORING PLATFORM

With Self-Healing Post-Quantum cryptography schemes implementation and a Border patrolling and monitoring system.

STARTUP

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Speciality: Networks,Information Systems & Security

2022/2023

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Quantum

SOLUTIONS

1/ THE CONTENT

Quantum SOLUTIONS

- INTRODUCTION
  - The problem
  - Our solution
  - Patent
- THE PROTOTYPE (INDUSTRIAL)
  - Kit overview
  - Sensors devices

1/ THE CONTENT

Quantum SOLUTIONS

THE PROTOTYPE (INDUSTRIAL)

- Mesh networks
- Node red
- MQTT Protocol
- Portainer

Quantum SOLUTIONS

- THE PROTOTYPE (INDUSTRIAL)
  - Connection operations
    - ESP-now
  - Drone
  - Web application for wsn monitoring
    - Node.js
    - Admin operations

Quantum SOLUTIONS

- THE PROTOTYPE (INDUSTRIAL)
  - Web application for wsn monitoring
    - Client operations
      - Raseberri pi geolocation using google maps api
      - WSN monitoring using javascript
      - Creating a web terminal and ssh connection
    - Web-token based authentication

Quantum SOLUTIONS

THE PROTOTYPE (INDUSTRIAL)

- Mobile application for wsn monitoring
  - Mobile application now
  - App development tools
  - Mobile application Needs
  - React-native webview
  - Mobile application GUI
- The main idea

1/ THE CONTENT

Quantum SOLUTIONS

- CRYPTOGRAPHY
  - Self-healing in routing vs cryptography
  - Post-quantum
- BMC
- Conclusion

1/ INTRODUCTION/ THE PROBLEM

- Security in urban/hostile areas
  - No electricity
  - Environment risk/hazards

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Quantum SOLUTIONS

- Mobile technology
  - Require infrastructure
  - Slow deployment
  - High cost

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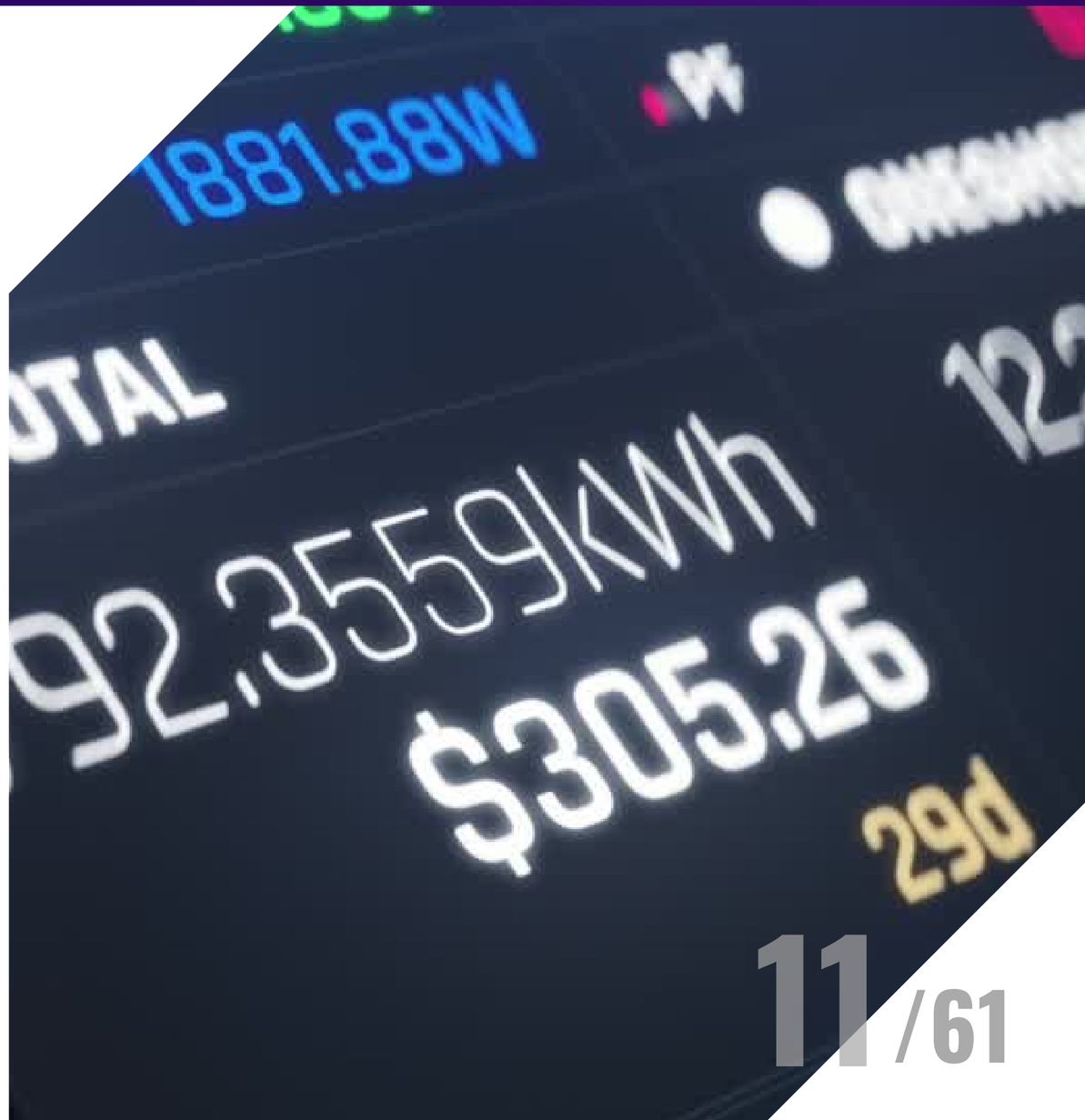

1/ INTRODUCTION/ THE PROBLEM

Quantum SOLUTIONS

- Hard to access technology
  - High introduction barrier
  - High maintenance cost

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Quantum SOLUTIONS

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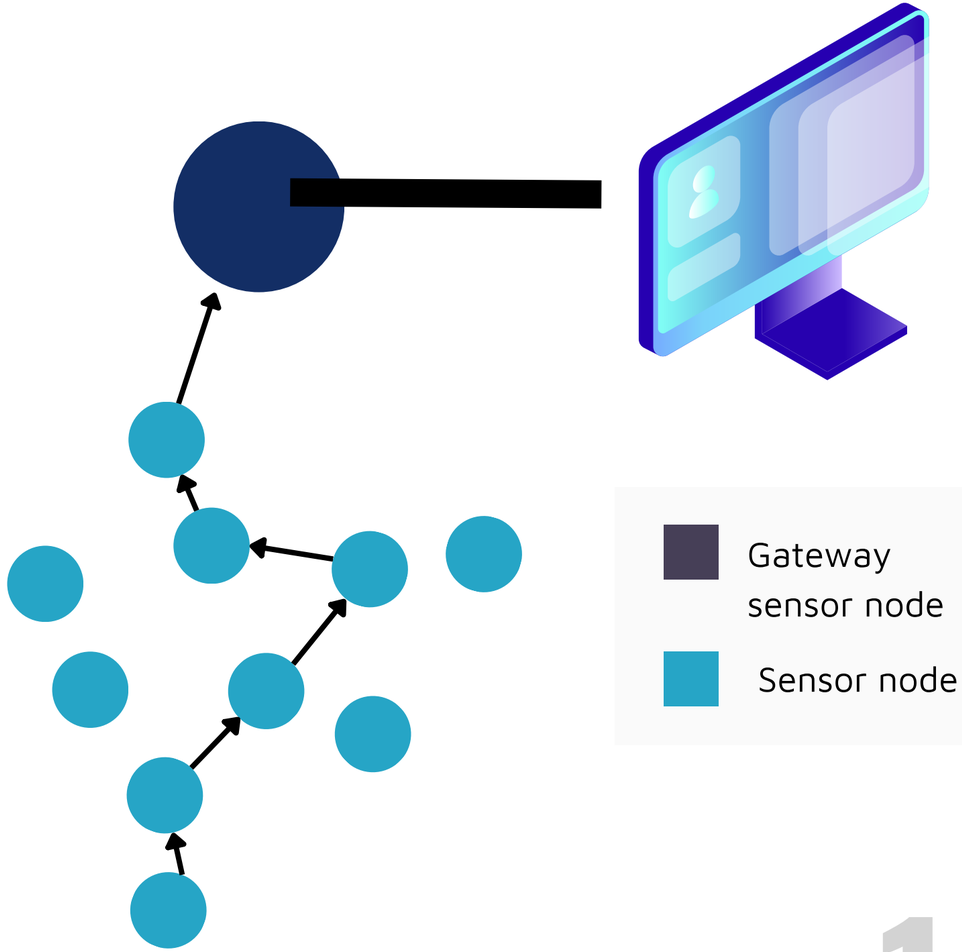
1/ INTRODUCTION/ THE SOLUTION

Quantum SOLUTIONS

WSN

A Wireless Sensor Network (WSN) is an infrastructure-less wireless network that is deployed in a large number of wireless sensors in an ad-hoc manner that is used to monitor the system, physical or environmental conditions.



Gateway sensor node

Sensor node

1/ INTRODUCTION/ THE PATENT

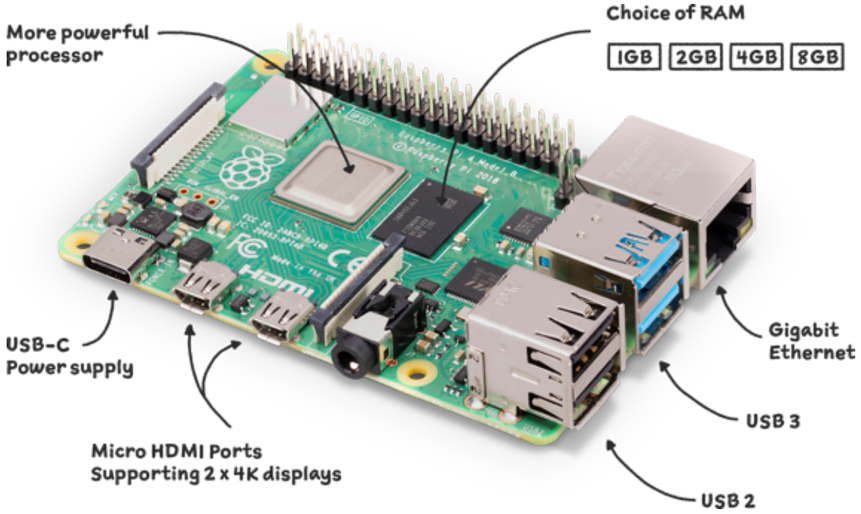
Quantum
SOLUTIONS

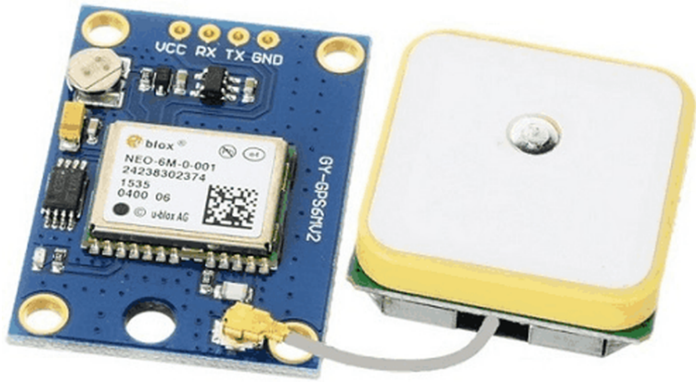
230949: Surveillance des frontieres a l'aide de reseaux de capteurs sans fil alimentes a l'energie solaire equipes de capteurs micro-ondes 24 GHz, de modules de suivi GPS, des protocoles ESP-NOW et LoRa pour les communications

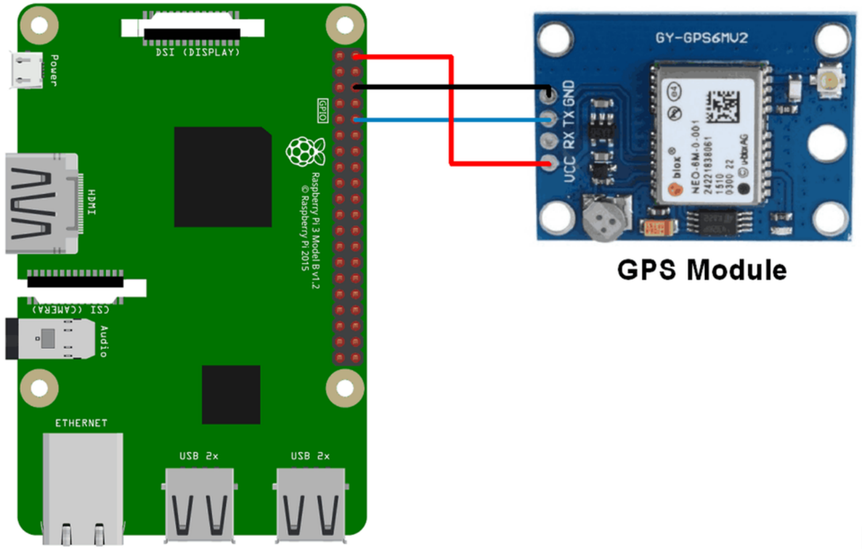
WSN's Monitoring Platform. With Self-Healing Post-Quantum cryptography schemes implementation and a Border patrolling and monitoring system got a patent from INAPI.

230949

2/ THE PROTOTYPE (INDUSTRIAL)/ KIT OVERVIEW







GPS Module

2/ THE PROTOTYPE (INDUSTRIAL)/ SENSOR DEVICE

Quantum SOLUTIONS

A

Low power (battery powered).

C

Slow CPU 8mhz to 1ghz.

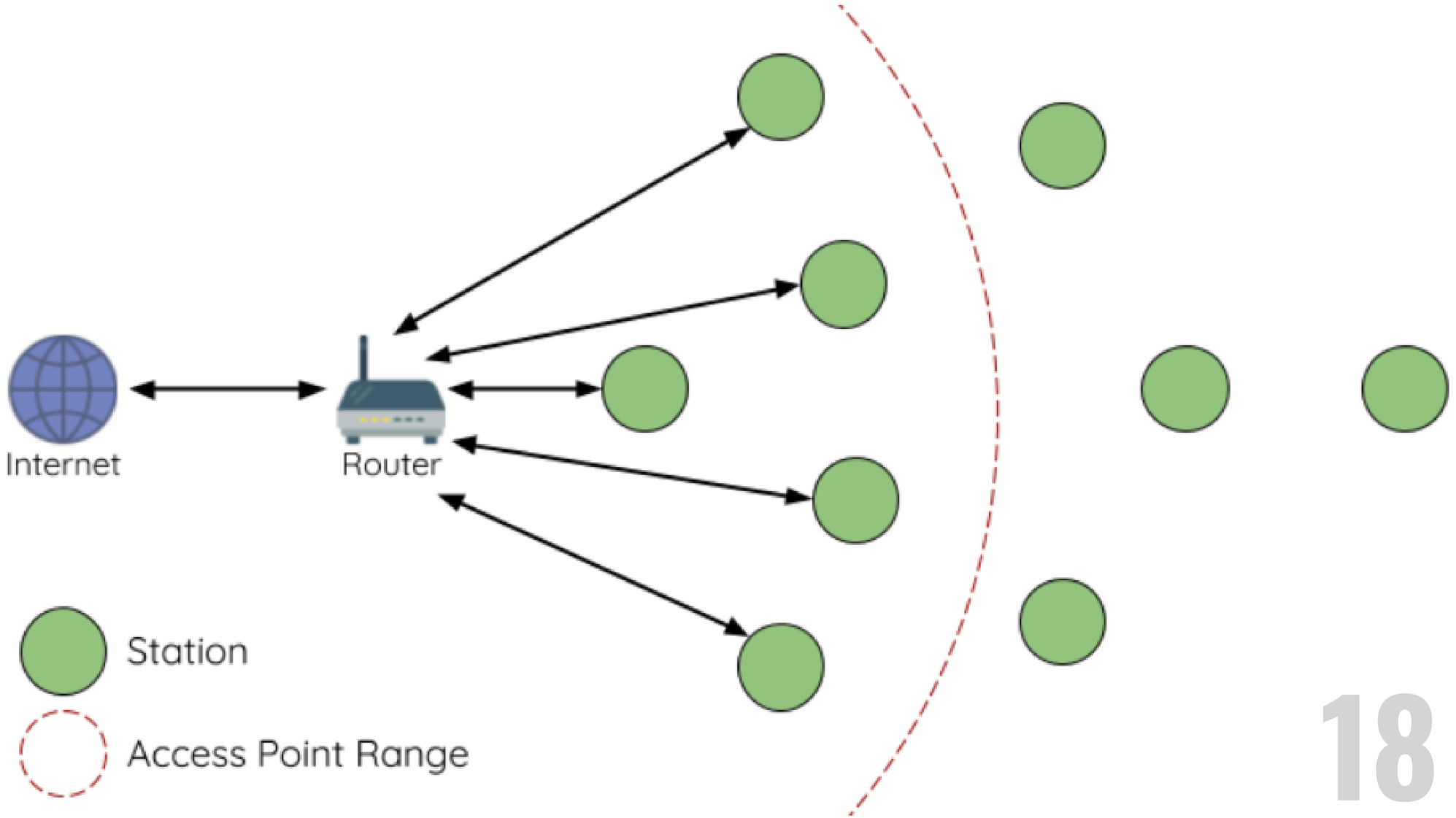
B

Limited Memory around 8KB.

D

.Low Bandwidth and short range.

2/ THE PROTOTYPE (INDUSTRIAL)/ MESH NETWORK



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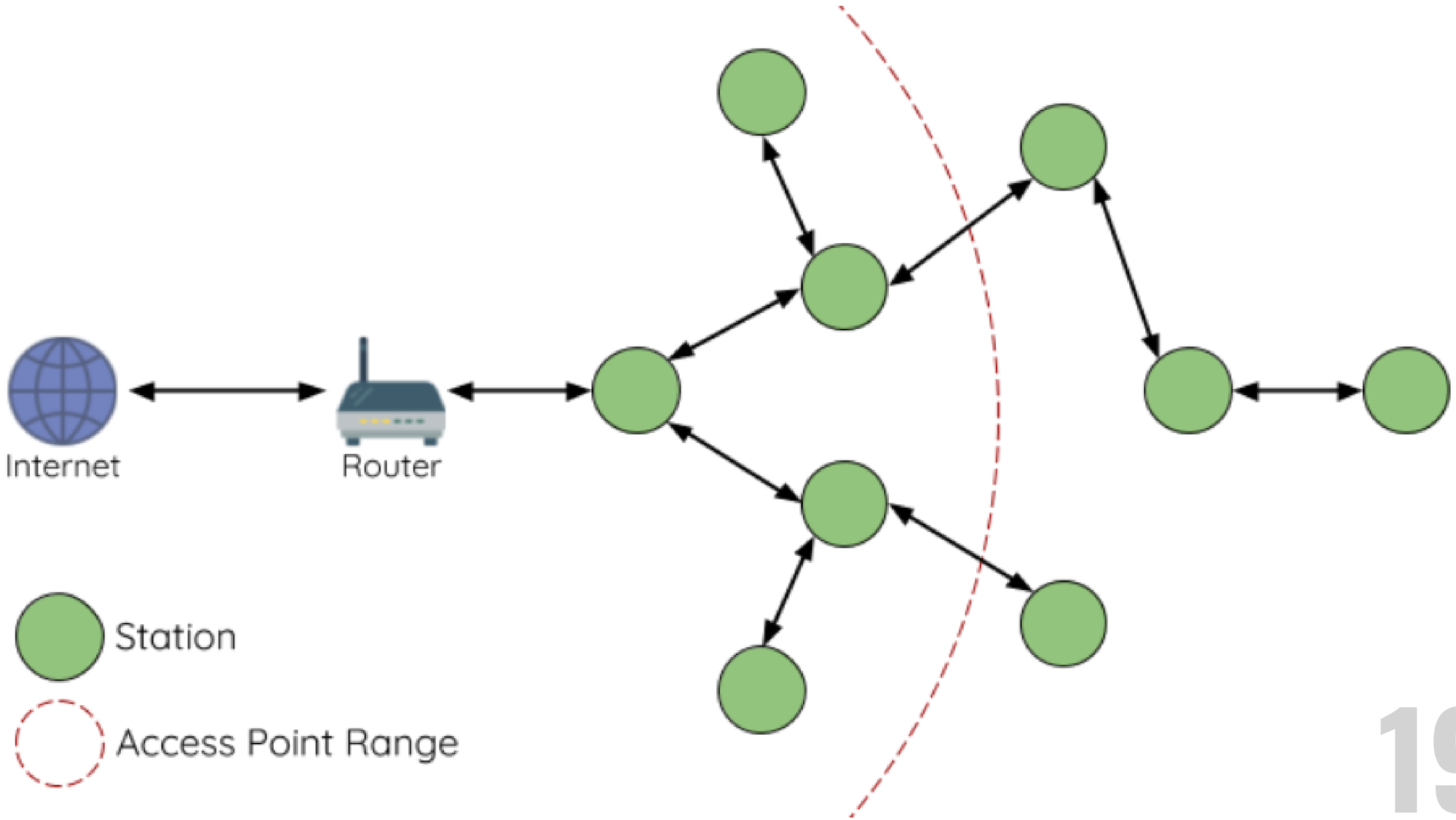

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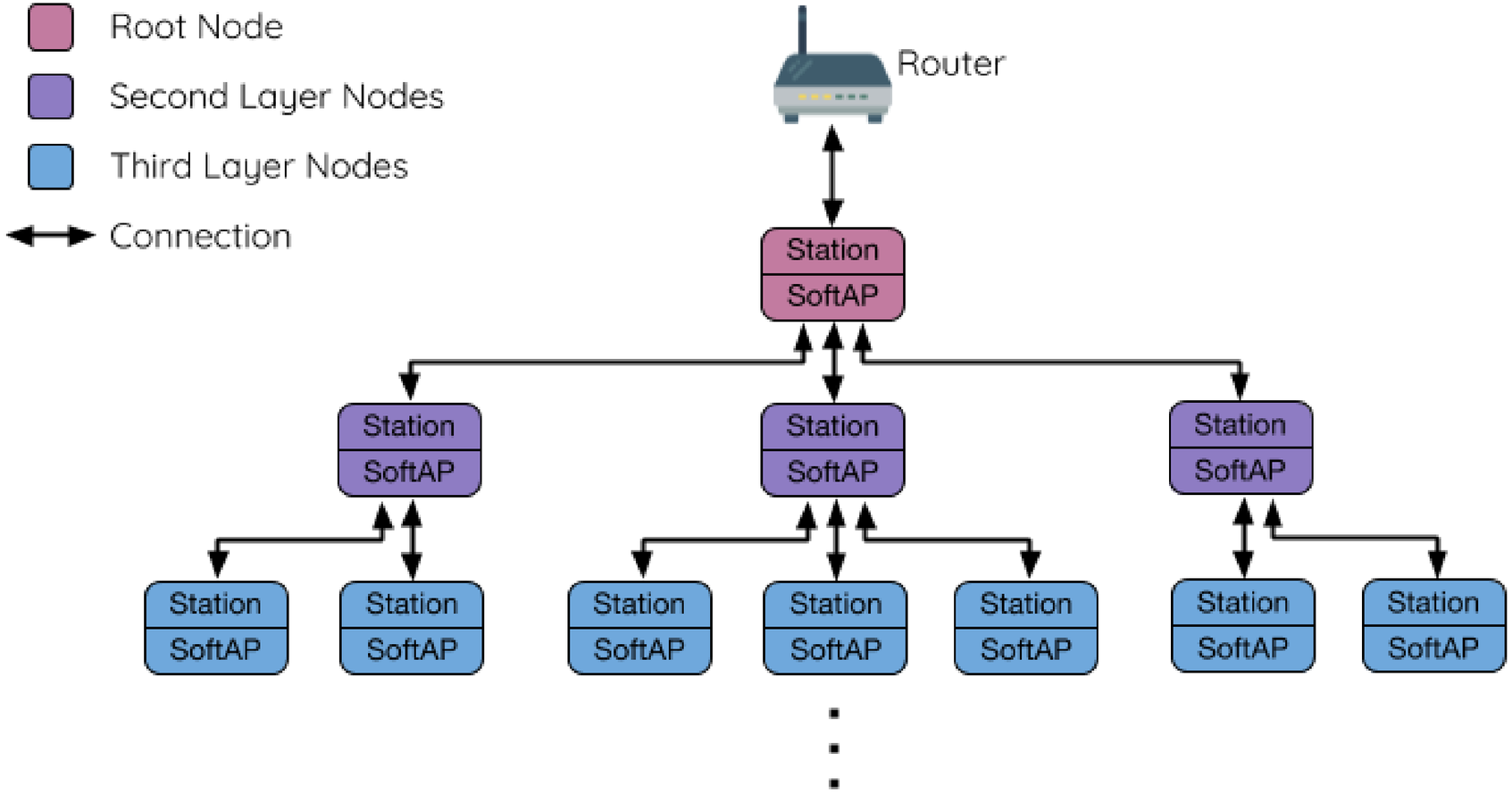

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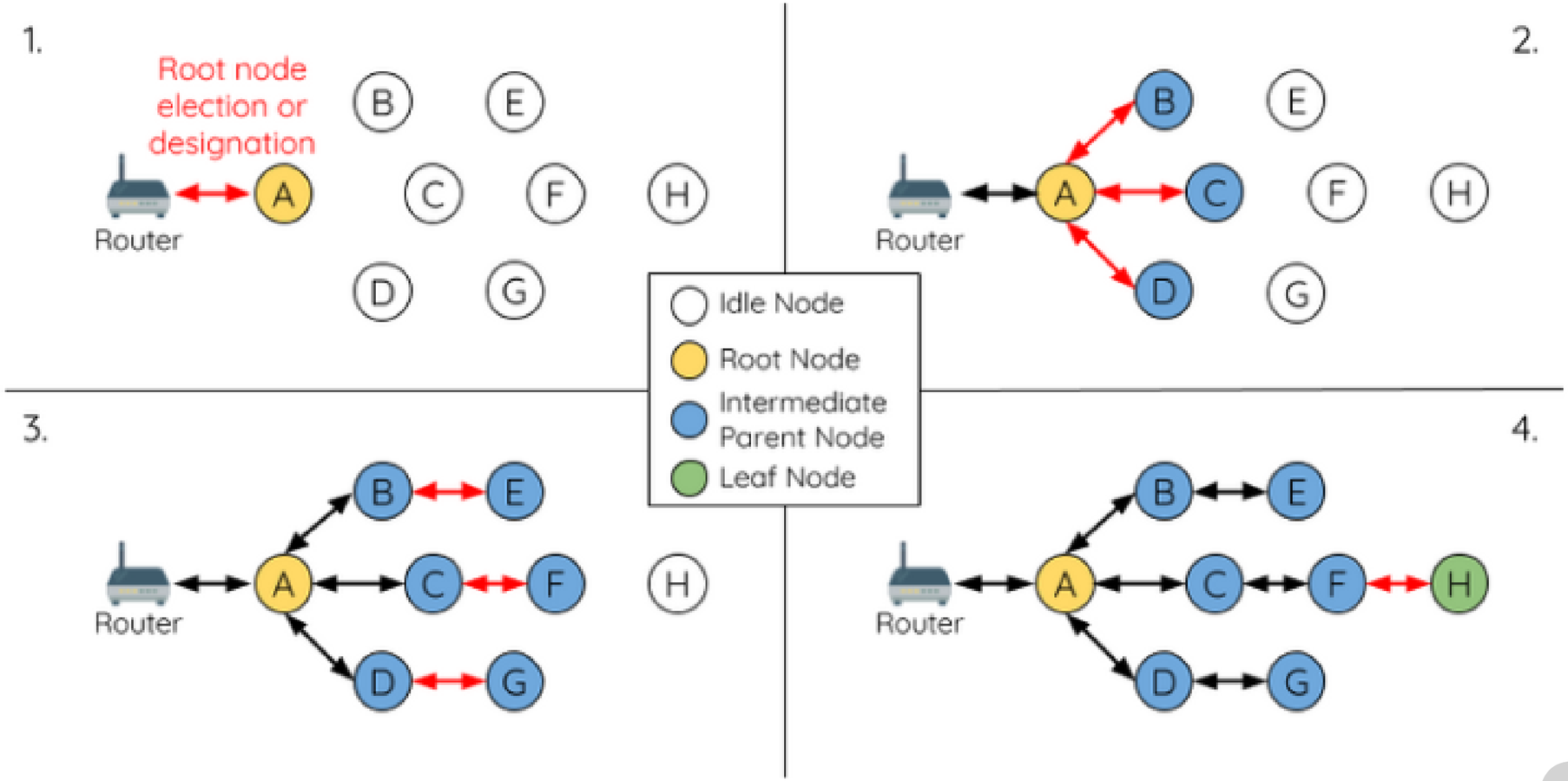

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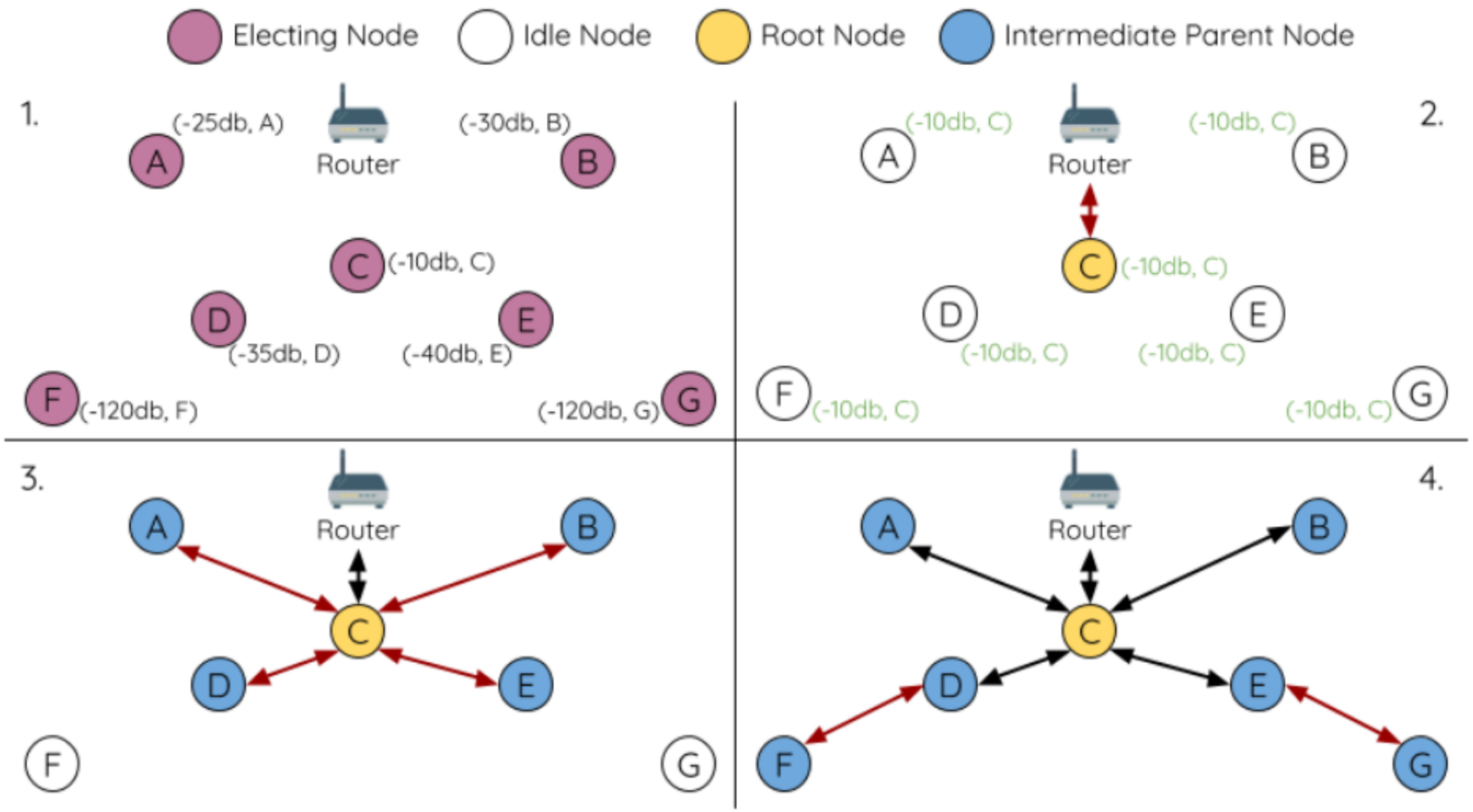
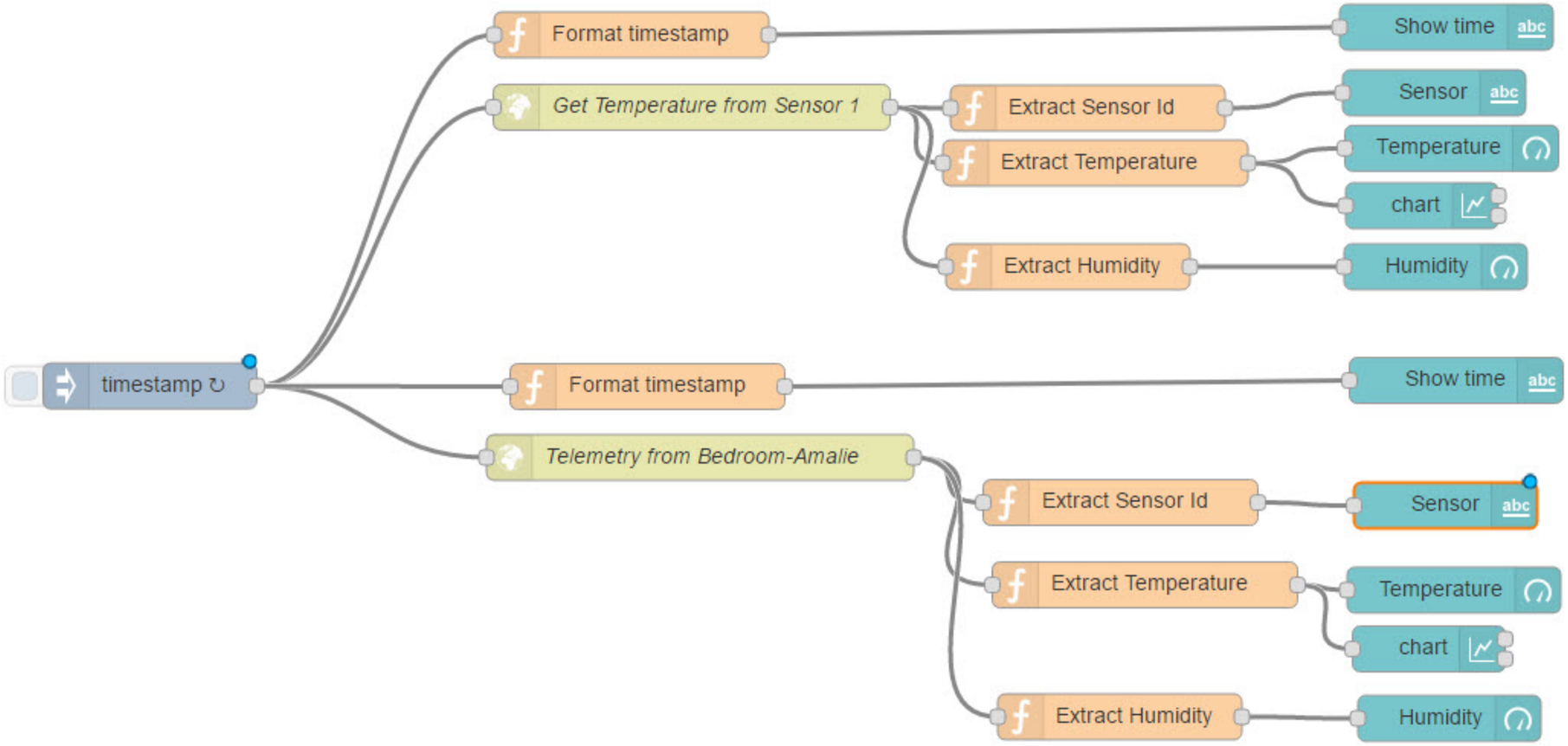
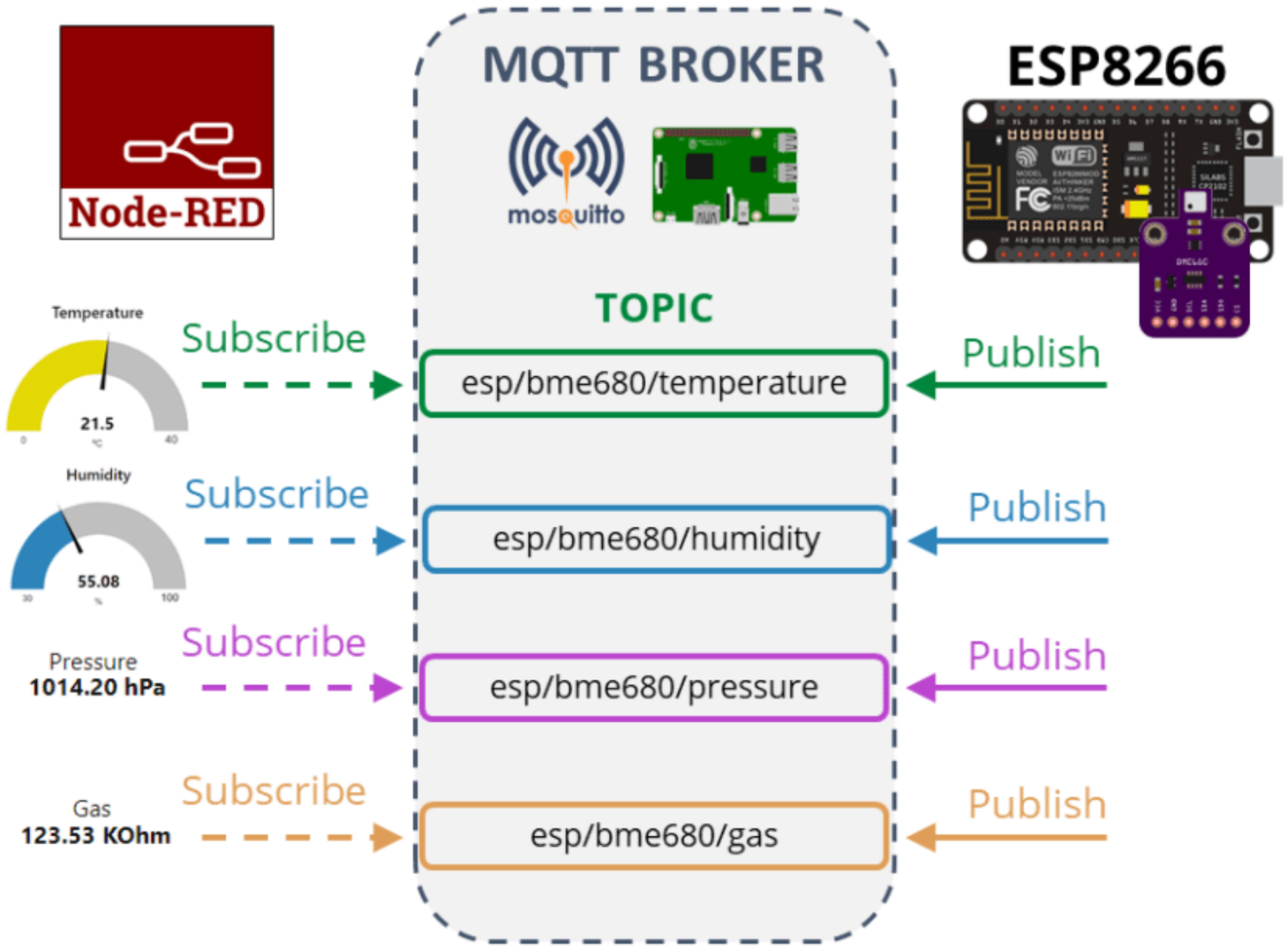


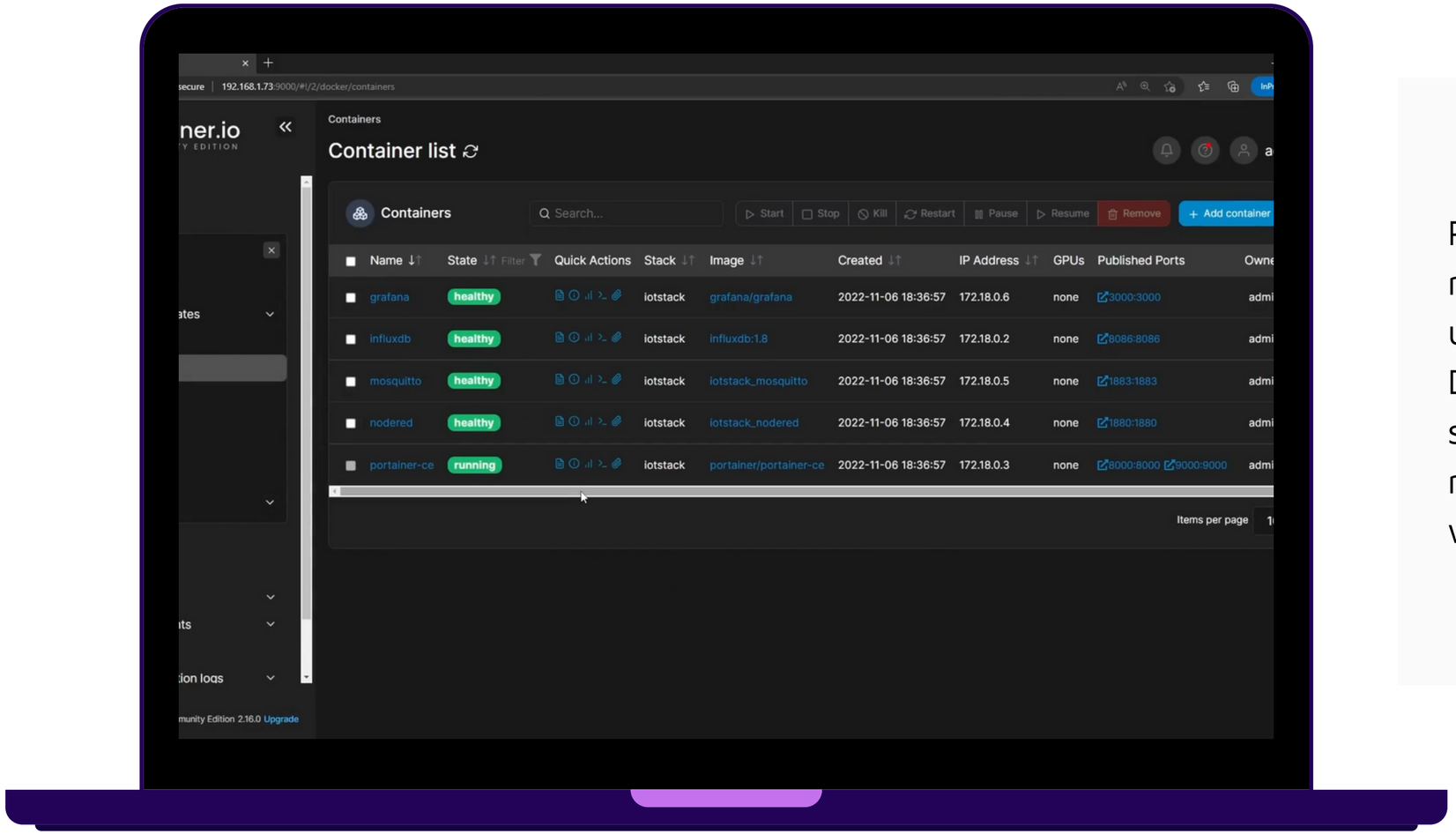
2/ THE PROTOTYPE (INDUSTRIAL)/ NODE RED



2/ THE PROTOTYPE (INDUSTRIAL)/ MQTT



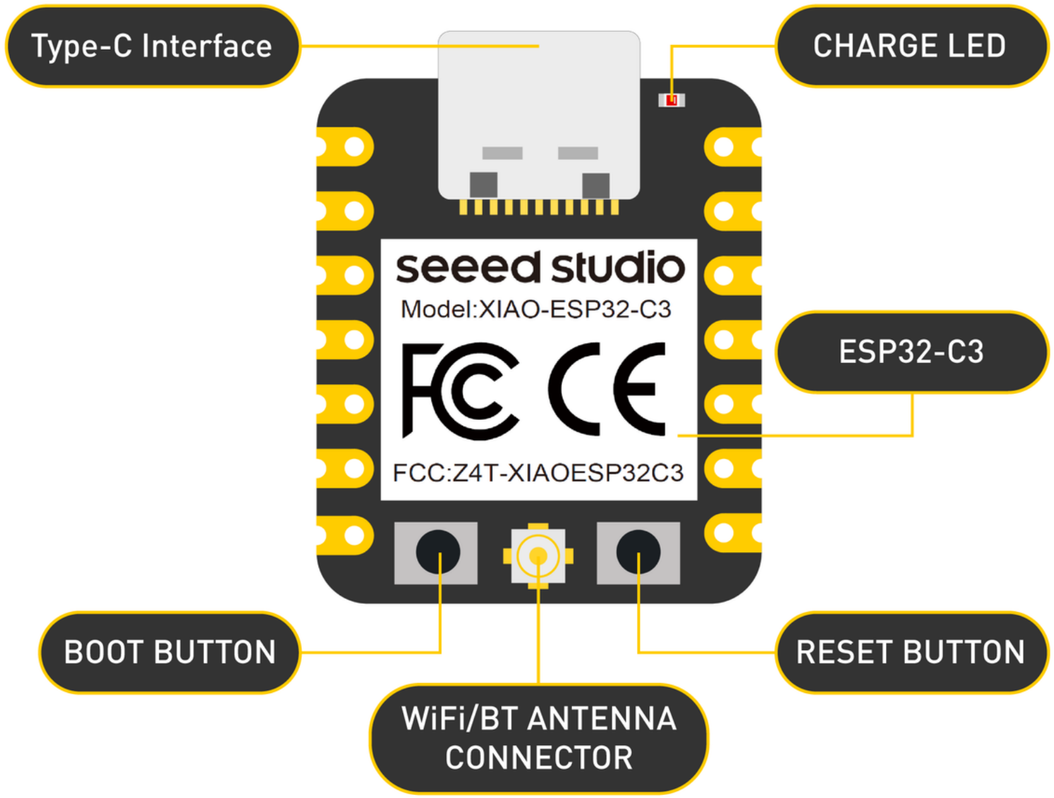
2/ THE PROTOTYPE (INDUSTRIAL)/ PORTAINER



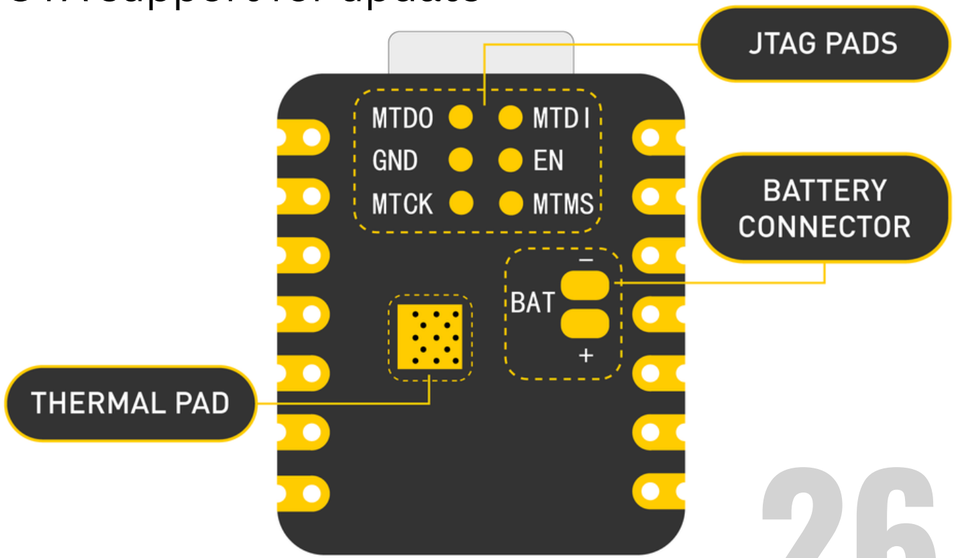
PORTAINER

Portainer is an open-source container management platform that provides a user-friendly interface for managing Docker containers and applications. It simplifies container deployment, monitoring, and management through a web-based graphical interface.

2/ THE PROTOTYPE (INDUSTRIAL)/ CONNECTION OP



- RISC-V single-core 32-bit chip processor with a four-stage pipeline that operates at up to 160 MHz
- Complete 2.4GHz Wi-Fi subsystem
- 400KB SRAM & 4MB Flash
- Circuit operating voltage: 3.3V@200mA
- Deep Sleep Model: >44 μA
- Charging current: 50mA/100mA
- OTA support for update



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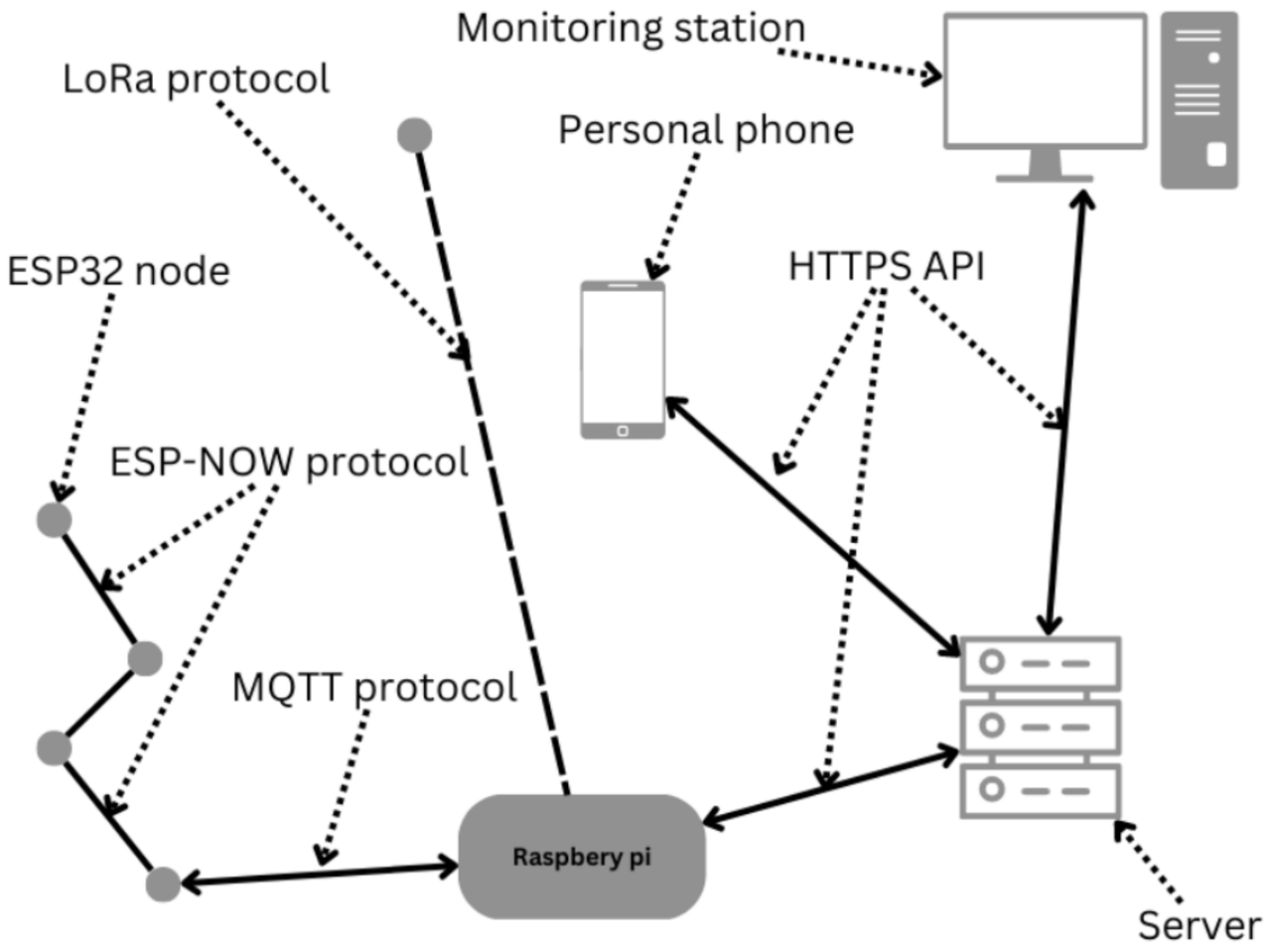
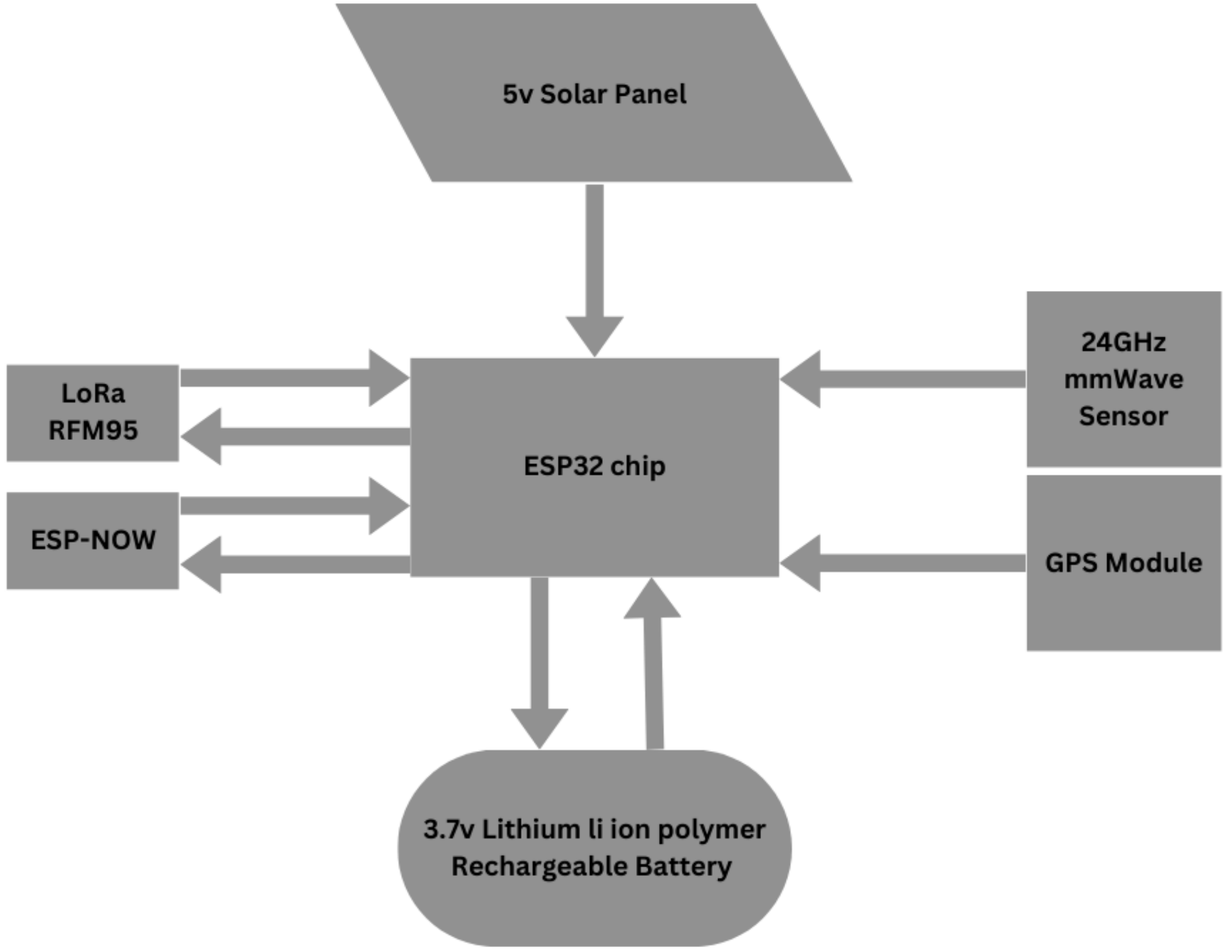


FIGURE 4.1: Sensor functioning components

2/ THE PROTOTYPE (INDUSTRIAL)/ CONNECTION OP



2/ THE PROTOTYPE (INDUSTRIAL)/ DRONE

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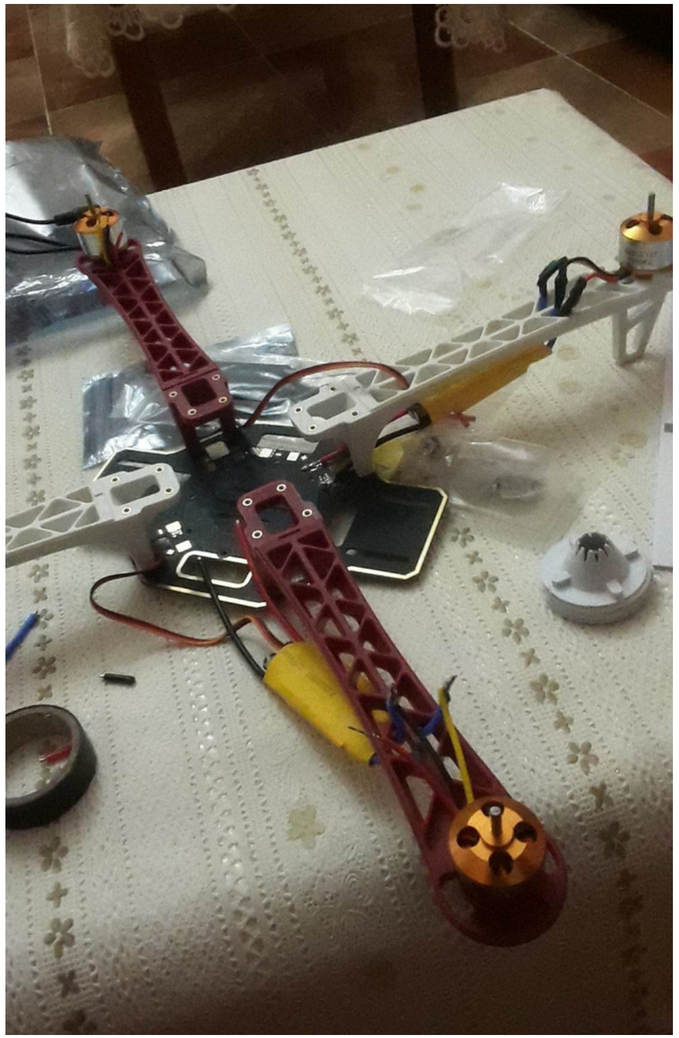

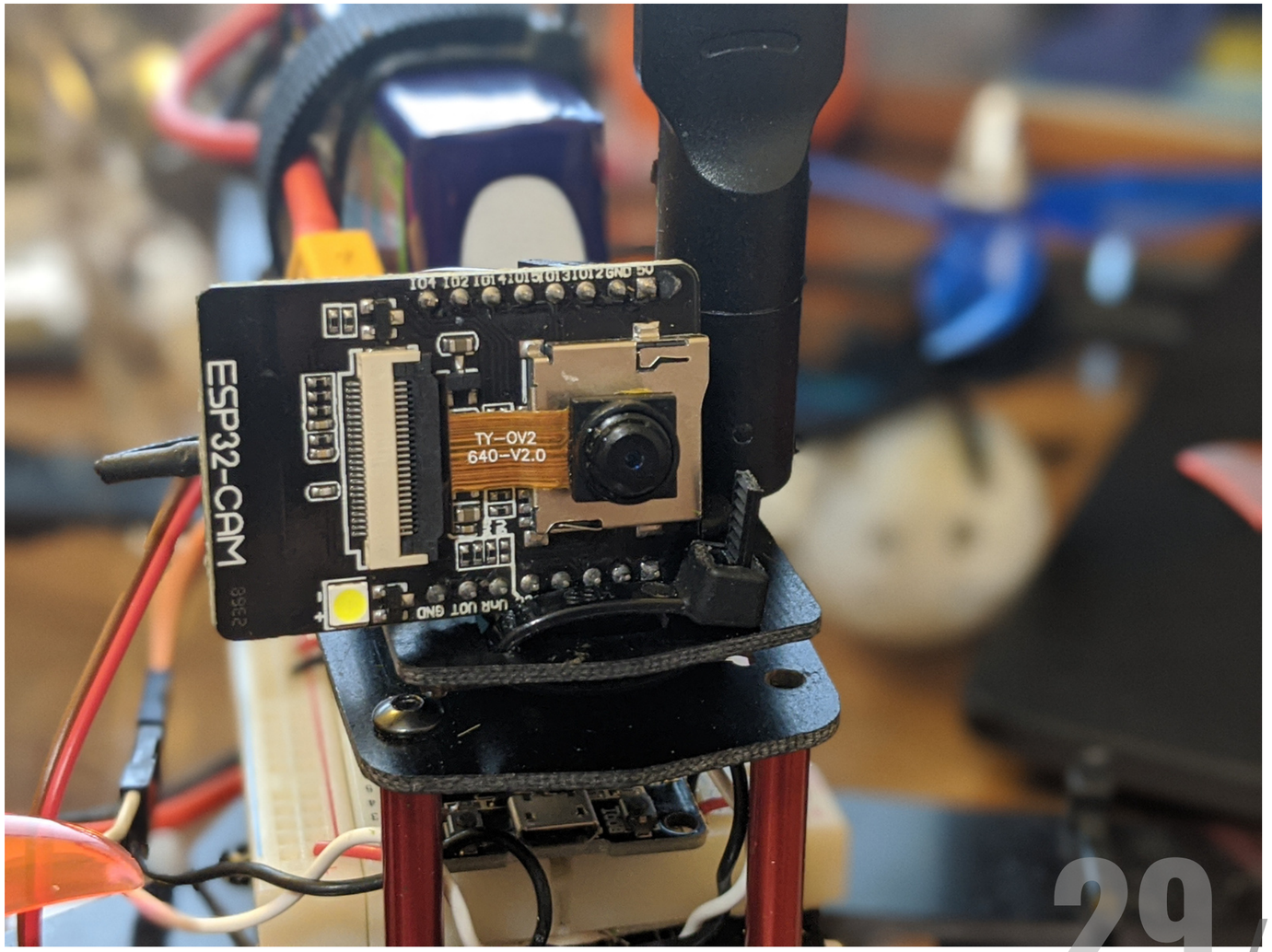

2/ / WEB APPLICATION MONITORING/ NODE.JS

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NODE.JS

Node.js is an open-source, cross-platform JavaScript runtime environment.

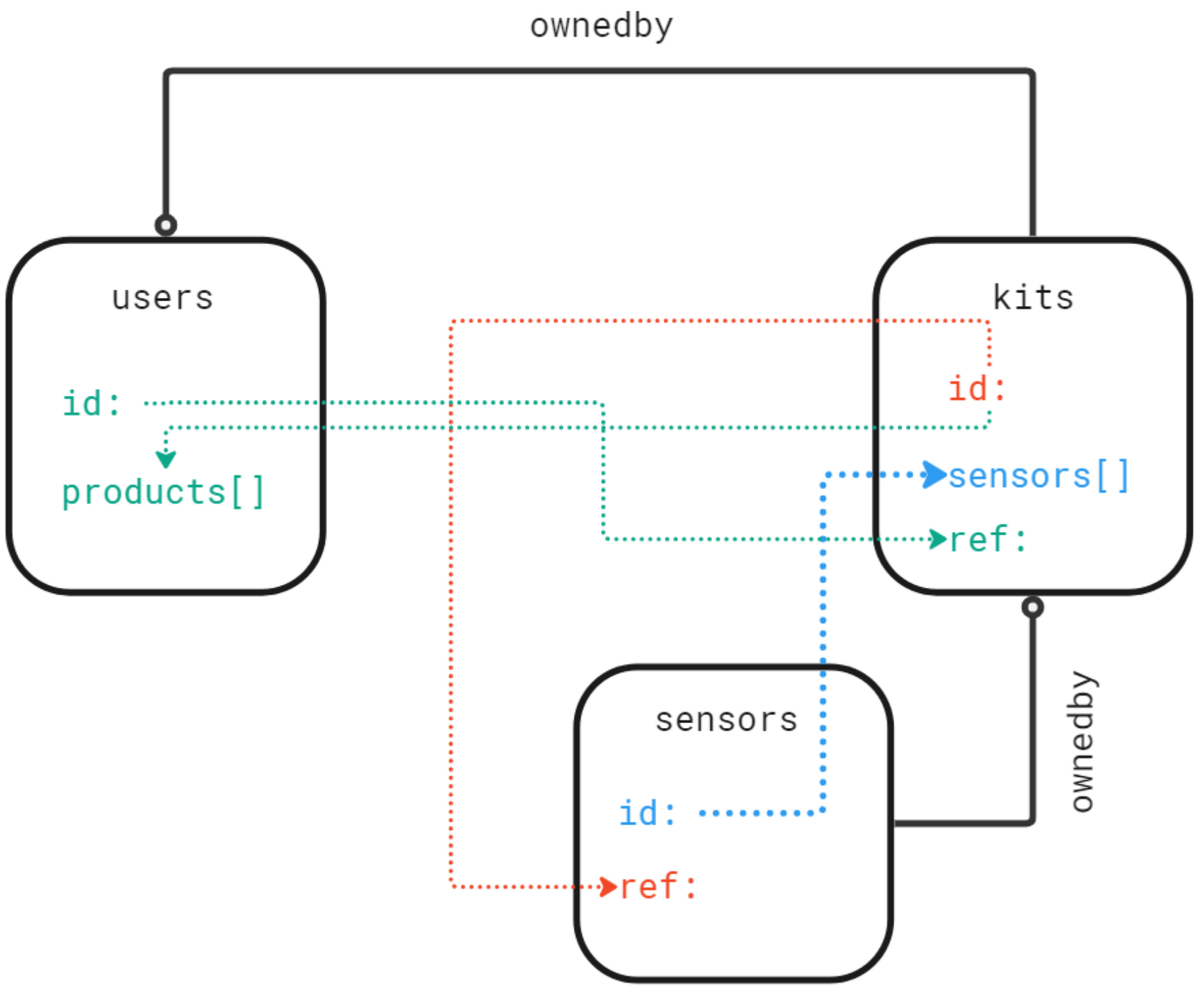
EXPRESS.JS

Express
Fast, unopinionated, minimalist web framework for Node.js

MONGODB

MongoDB is a popular open-source NoSQL database that provides a flexible and scalable solution for storing and managing structured, semi-structured, and **unstructured data.**

2/ THE PROTOTYPE (INDUSTRIAL)/ ADMIN OPERATION



2/ THE PROTOTYPE (INDUSTRIAL)/ CLIENT OPERATION

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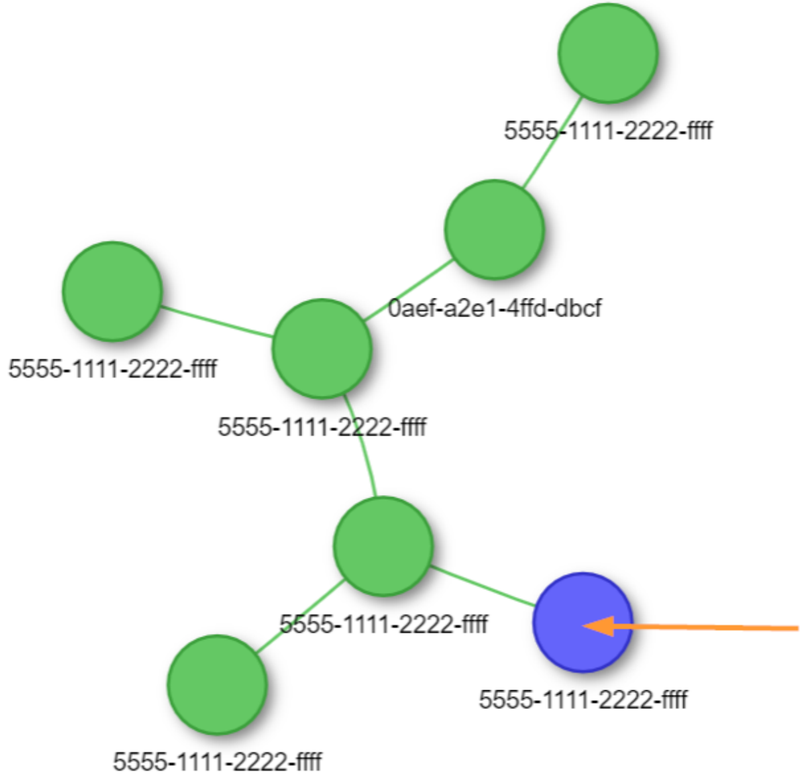
Raseberri pi geolocation using GPS

2/ THE PROTOTYPE (INDUSTRIAL)/ CLIENT OPERATION



Raseberi pi

Creating a fully functional javascript map monitoring from scratch without using any librariry.

2/ THE PROTOTYPE (INDUSTRIAL)/ CLIENT OPERATION

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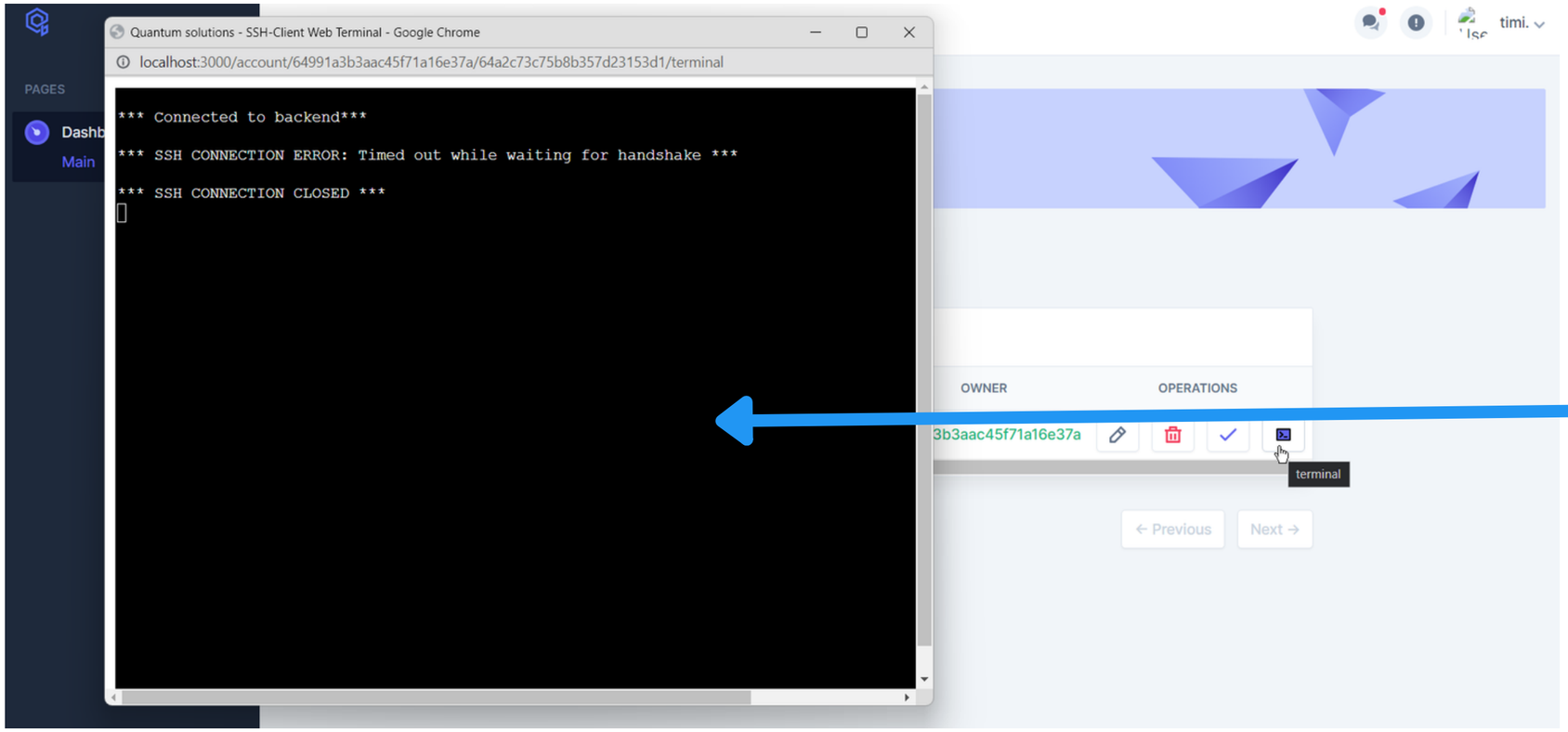
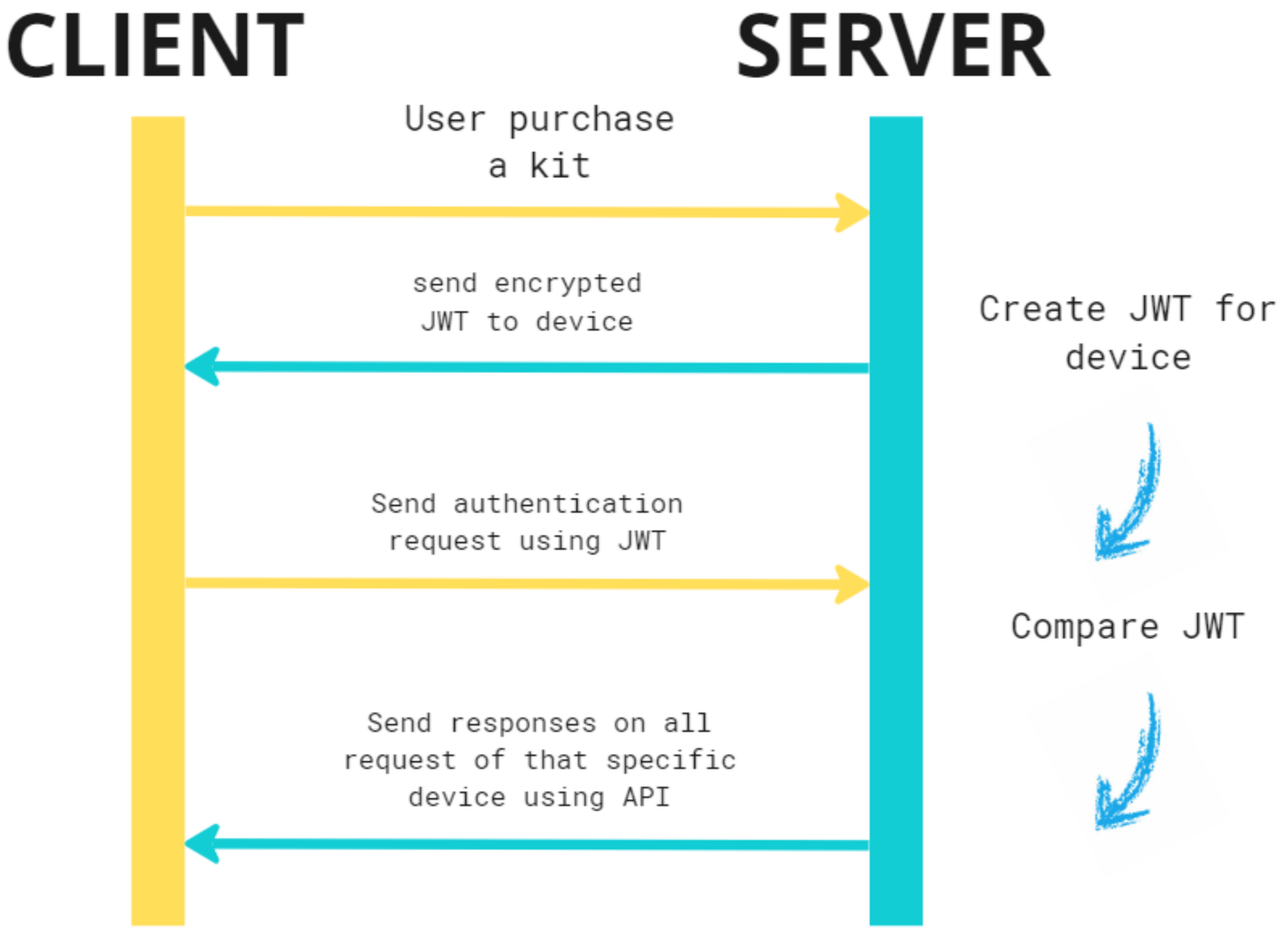


Creating a fully functional web terminal that can used ssh to connect to raseberri pi **remotely from sratch.**

2/ THE PROTOTYPE (INDUSTRIAL)/ CLIENT OPERATION



2///MOBILE APPLICATION NOW

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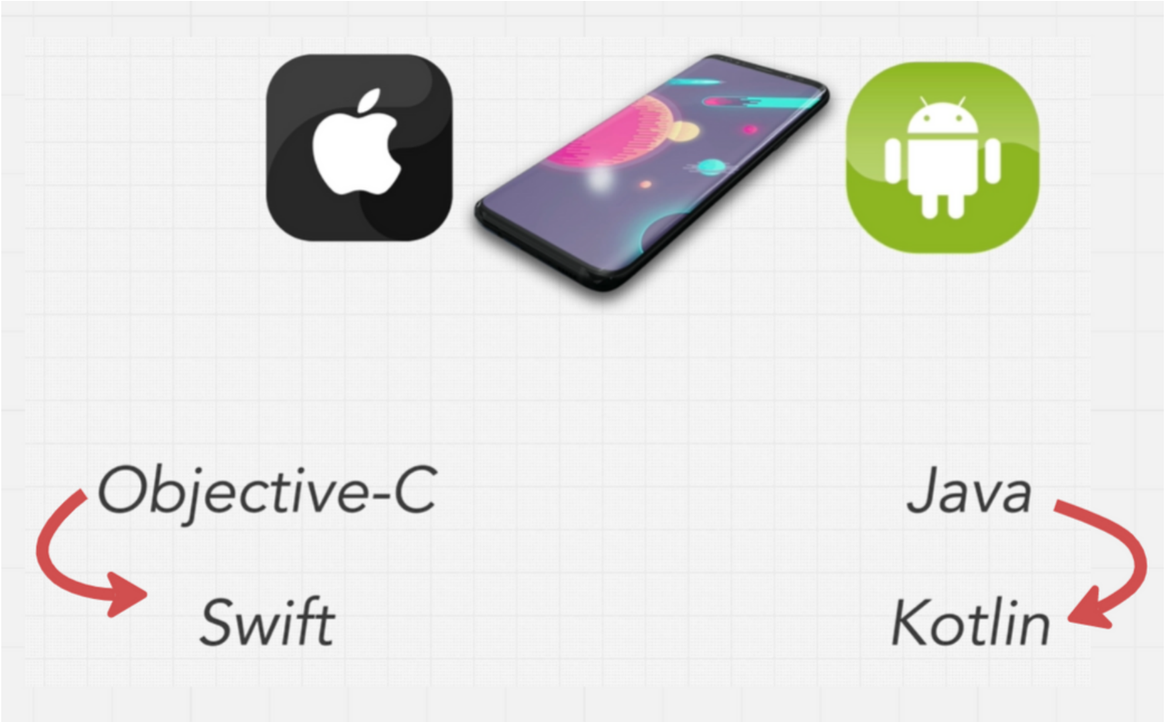

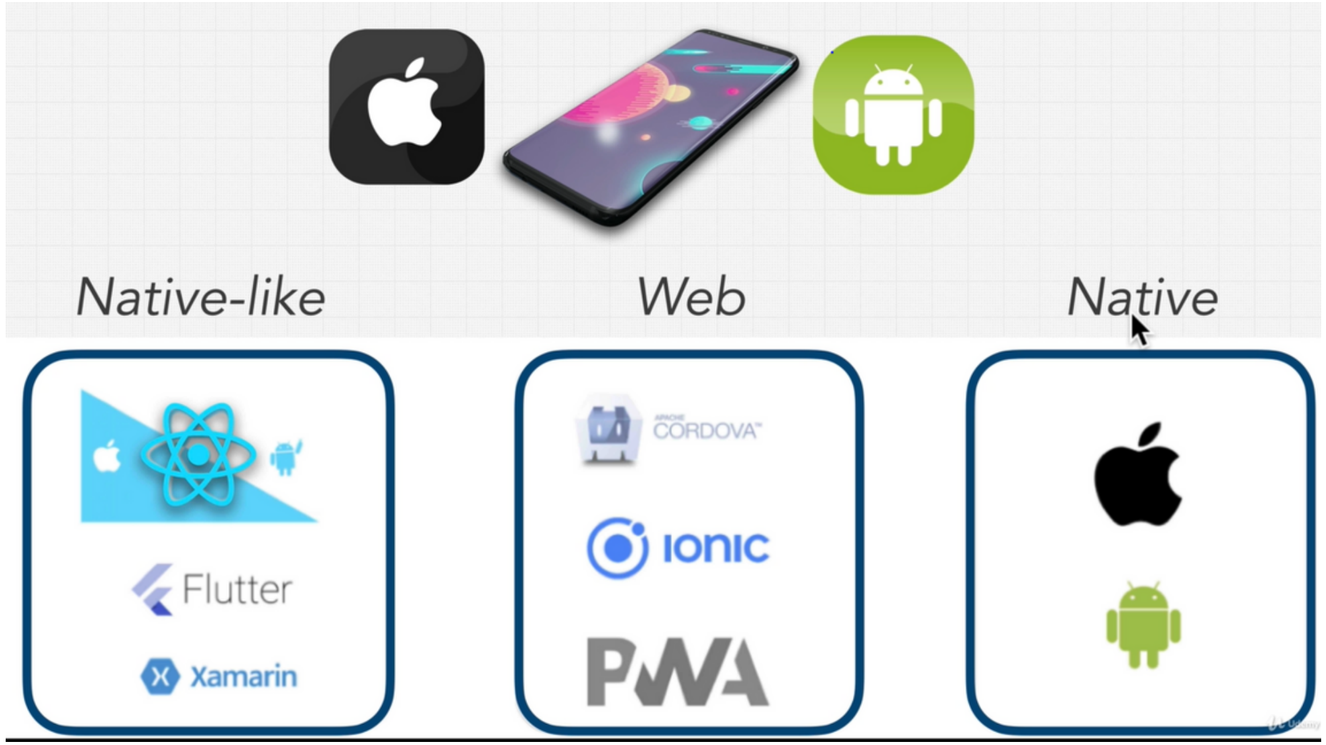

Quantum SOLUTIONS

“Learn once, write anywhere.”

React-native

React Native lets you create truly native apps and doesn't compromise your users' experiences.

Expo

Expo is an open-source platform for making universal native apps for Android, iOS, and the web with JavaScript and React.

Android/ios

compatible with both platforms ios & android which consist 90% of the market.

2///MOBILE APPLICATION NEEDS

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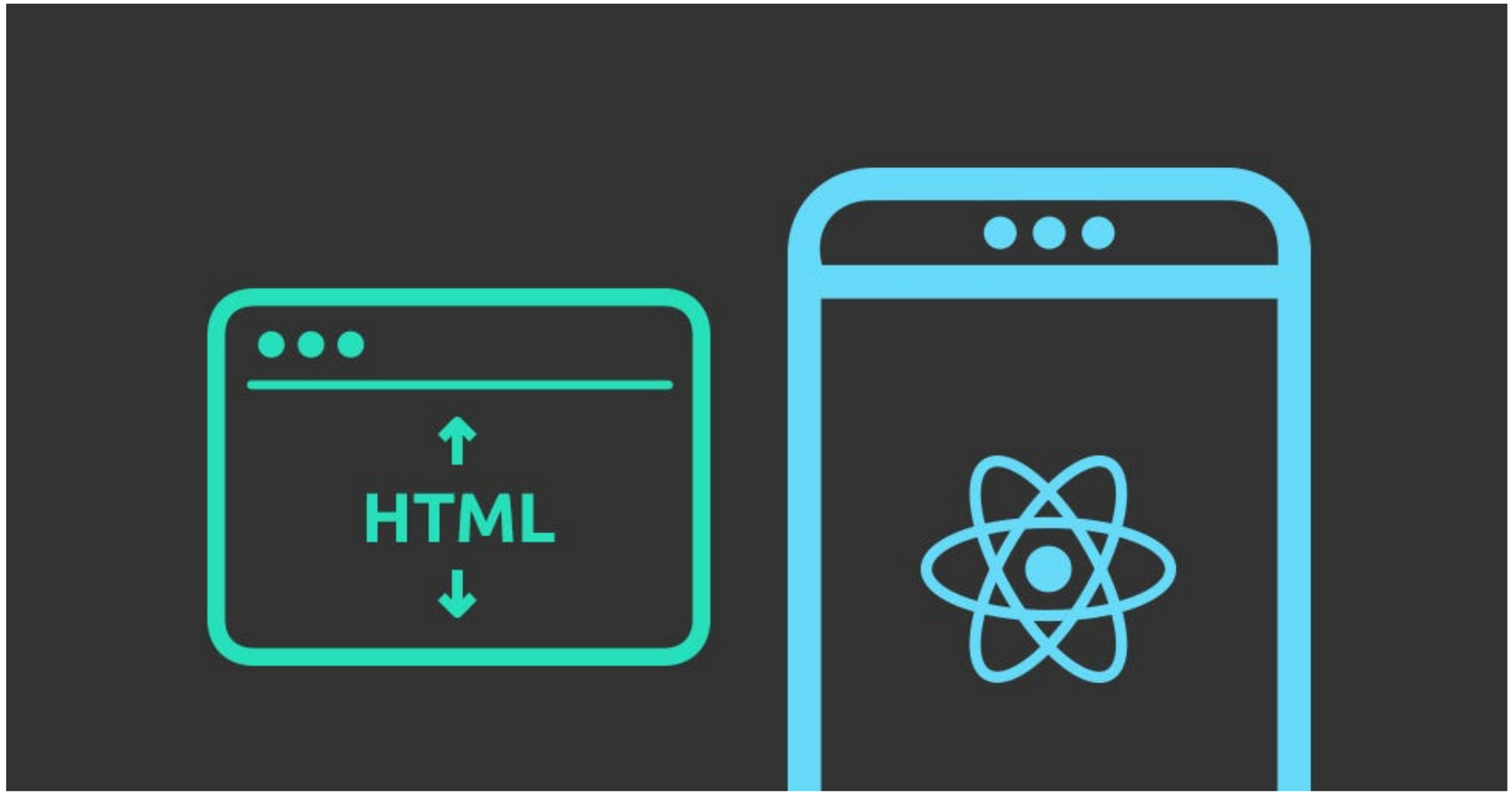
conditions

- Accessibility and Convenience:
- Remote Monitoring
- Financial Impact
- Integration and Automation
- Easy Installation and Scalability

2///REACT-NATIVE WEBVIEW



2///MOBILE APPLICATION GUI

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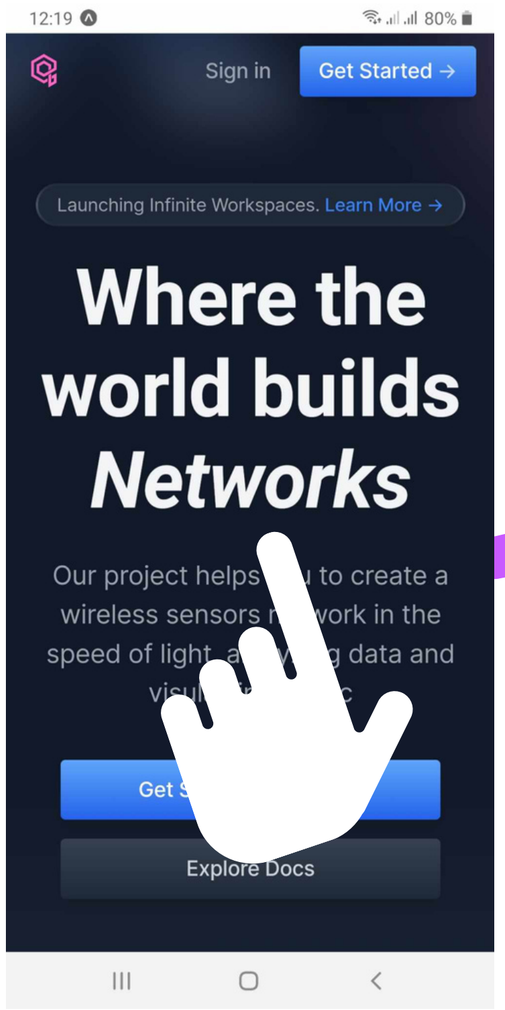

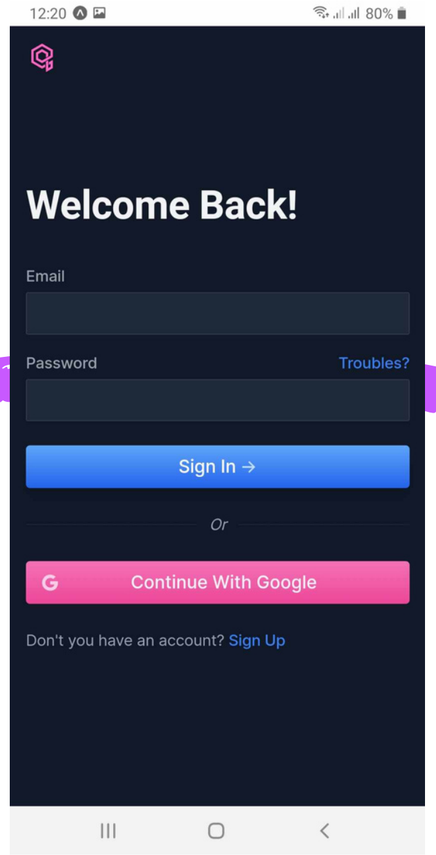

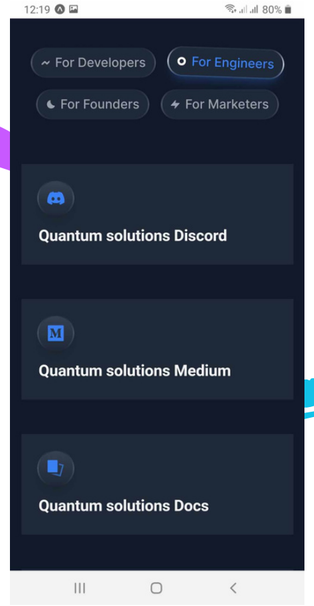

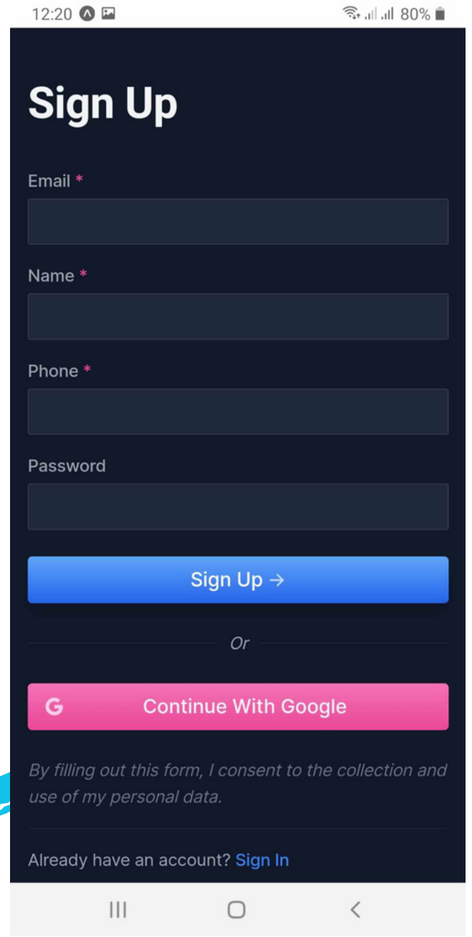

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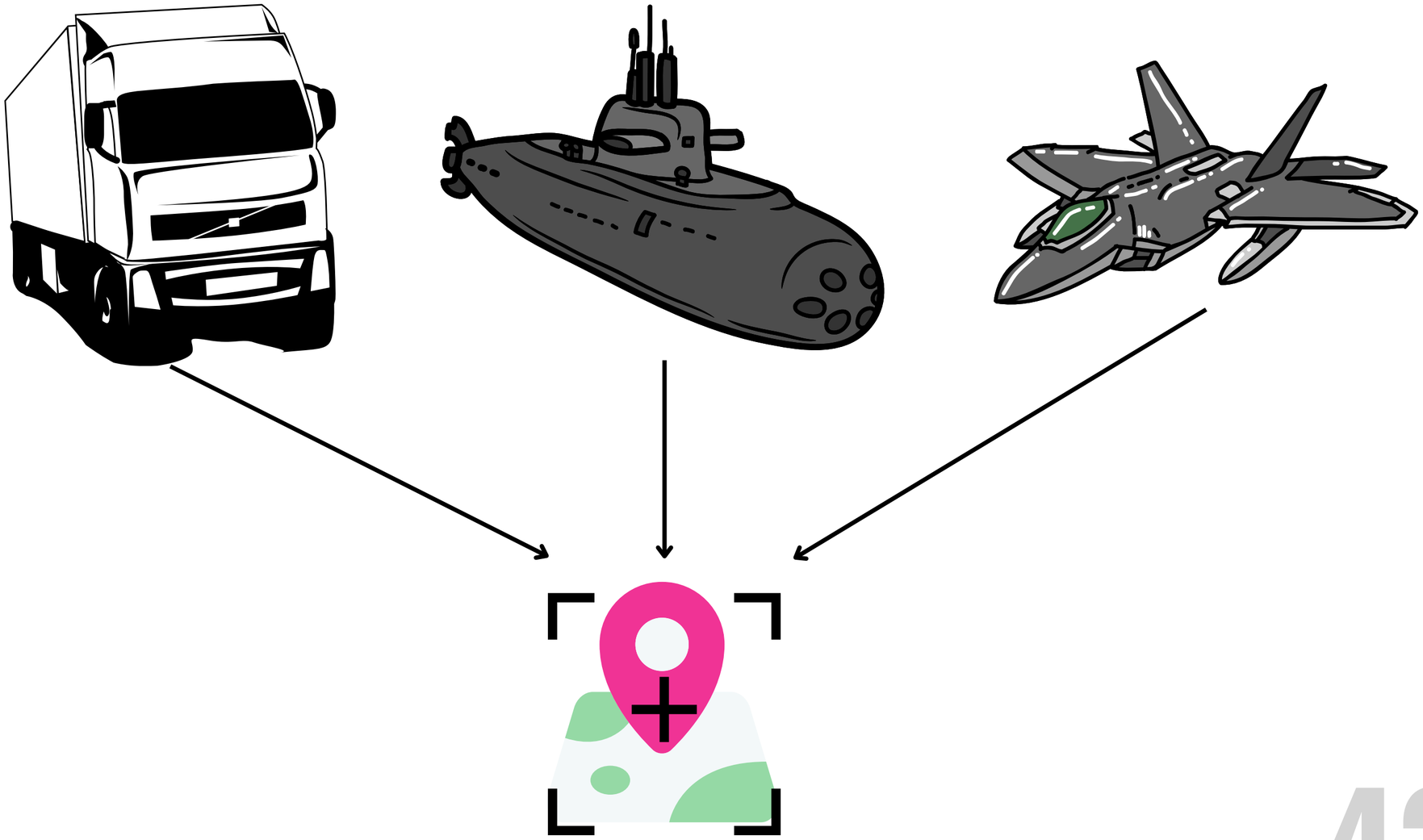
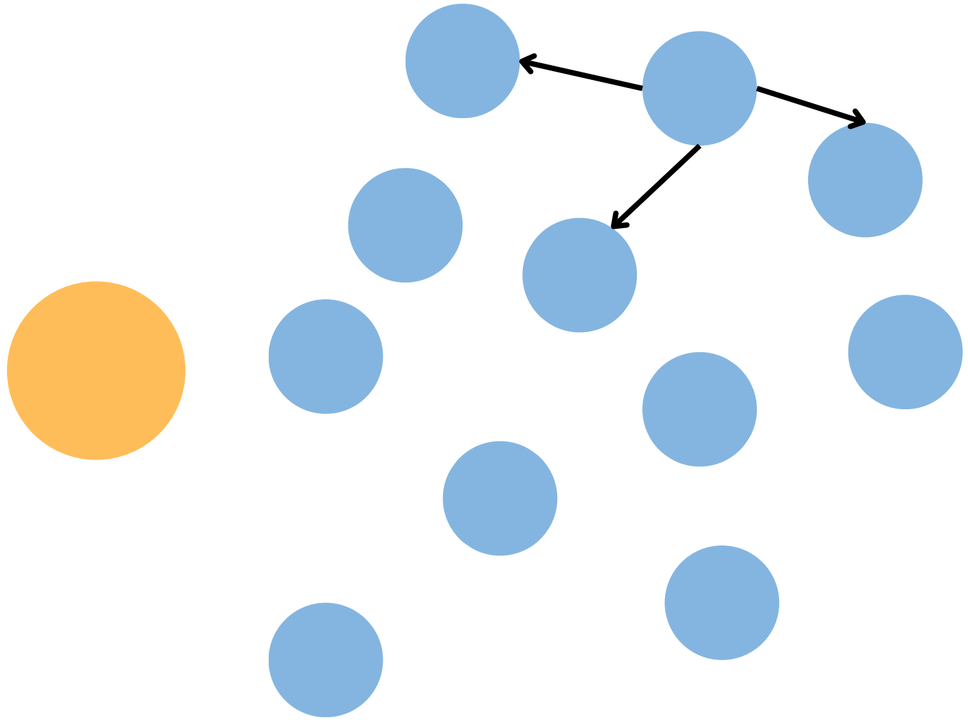
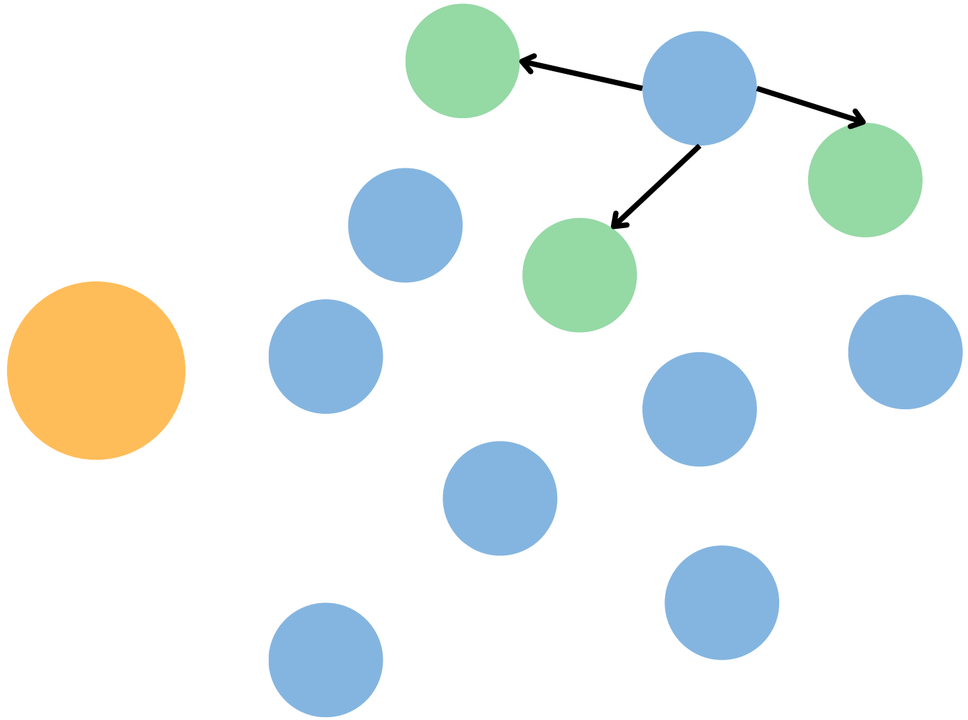
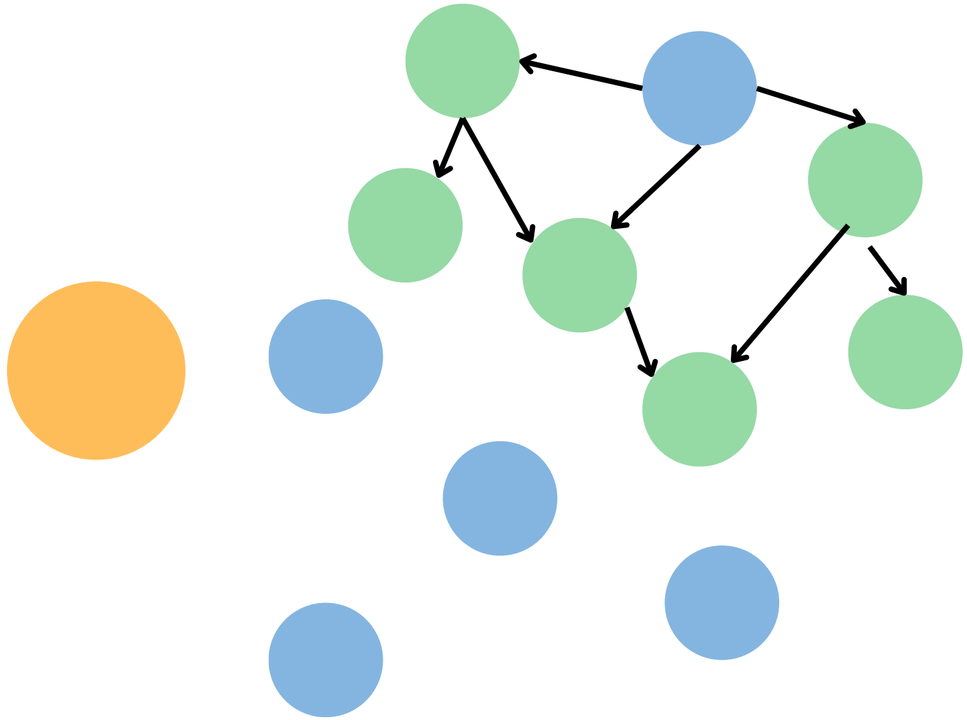
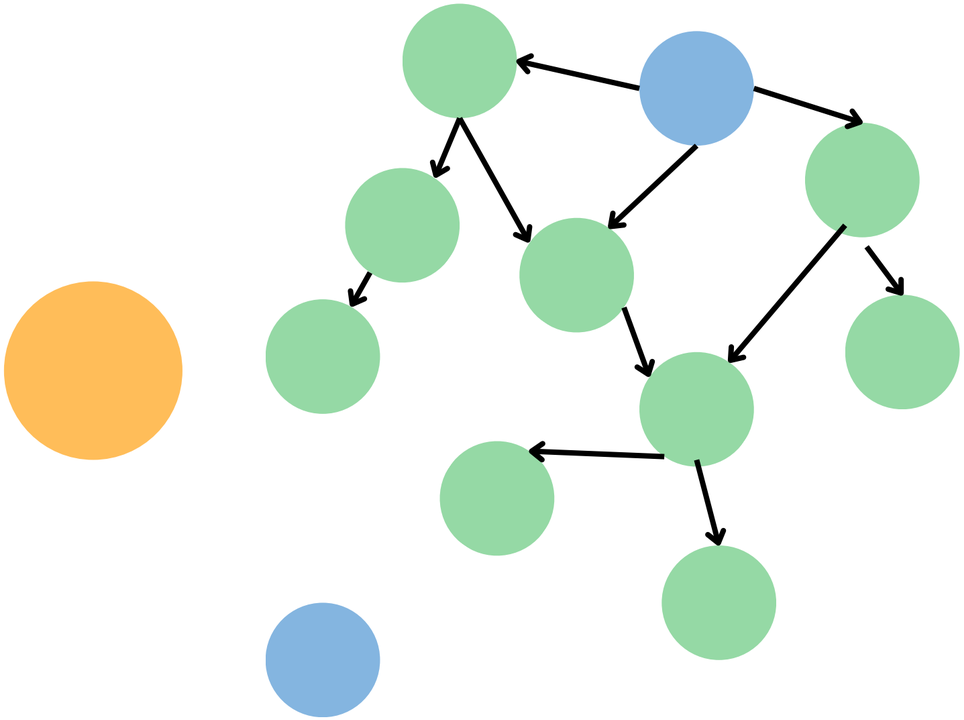
WHAT IS A WSN PLATFORM ?

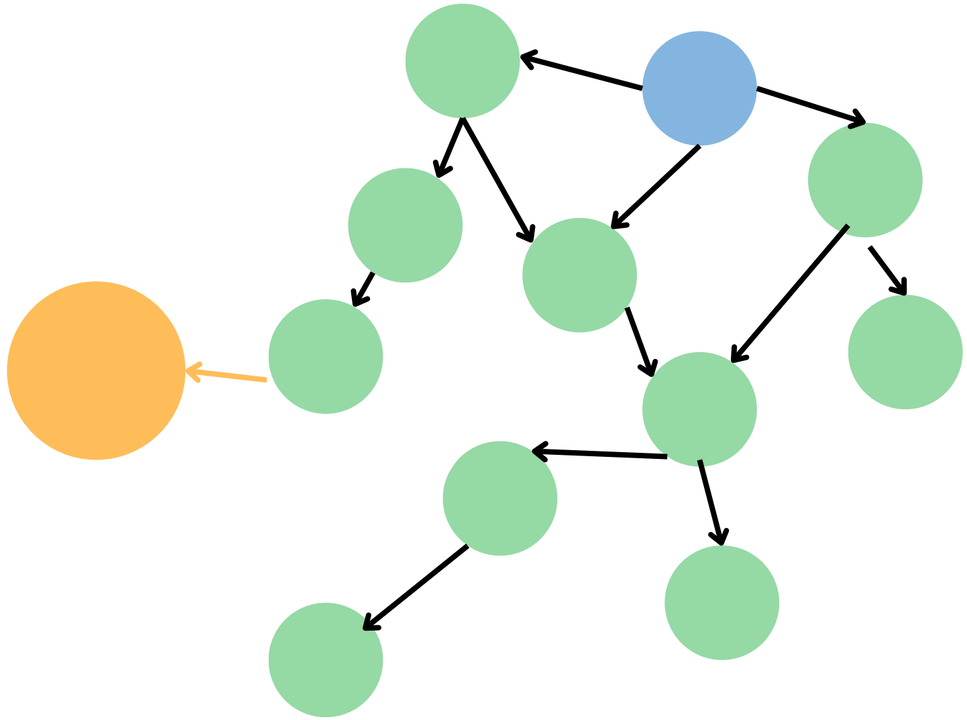


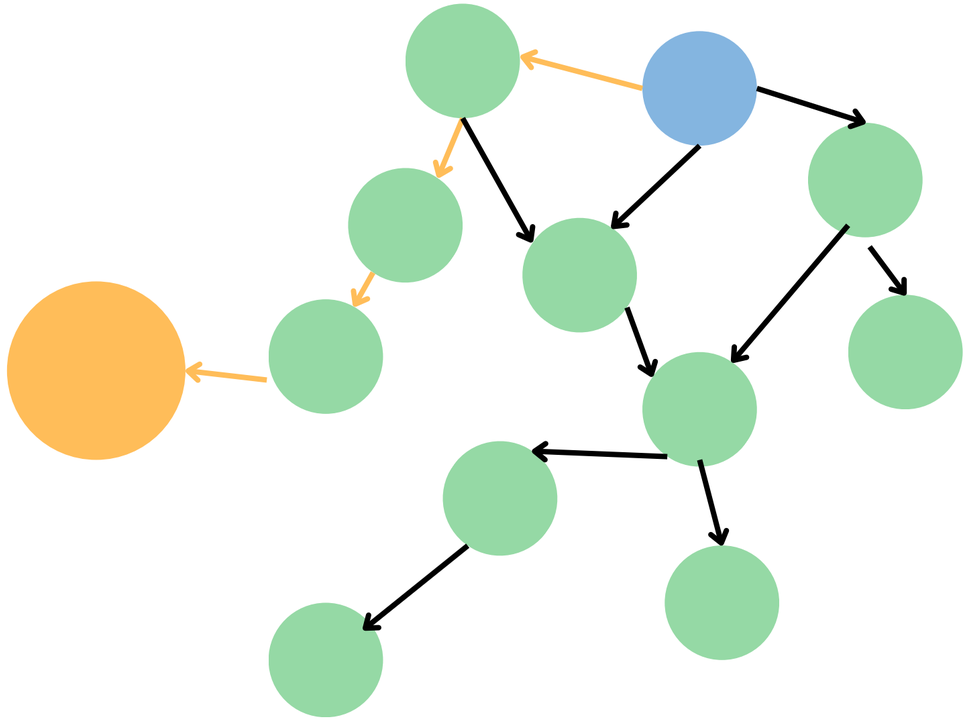


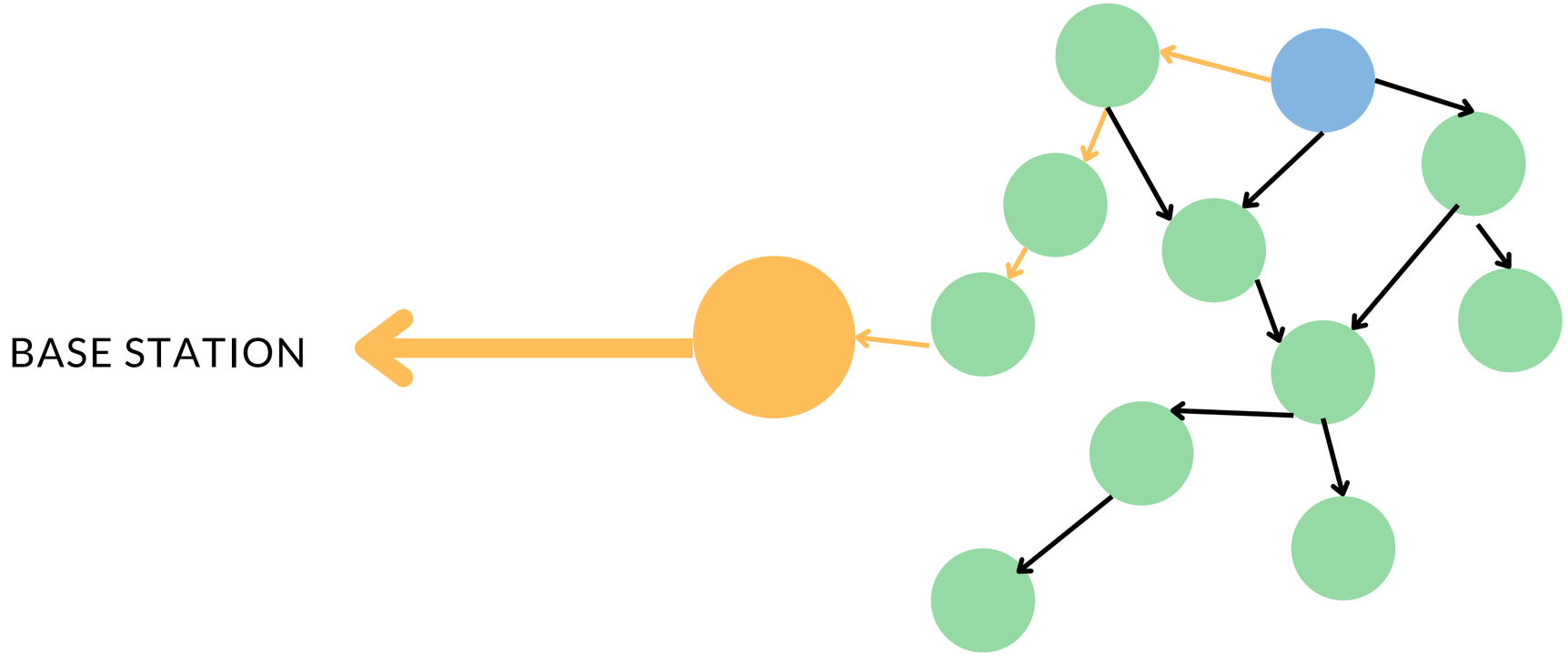












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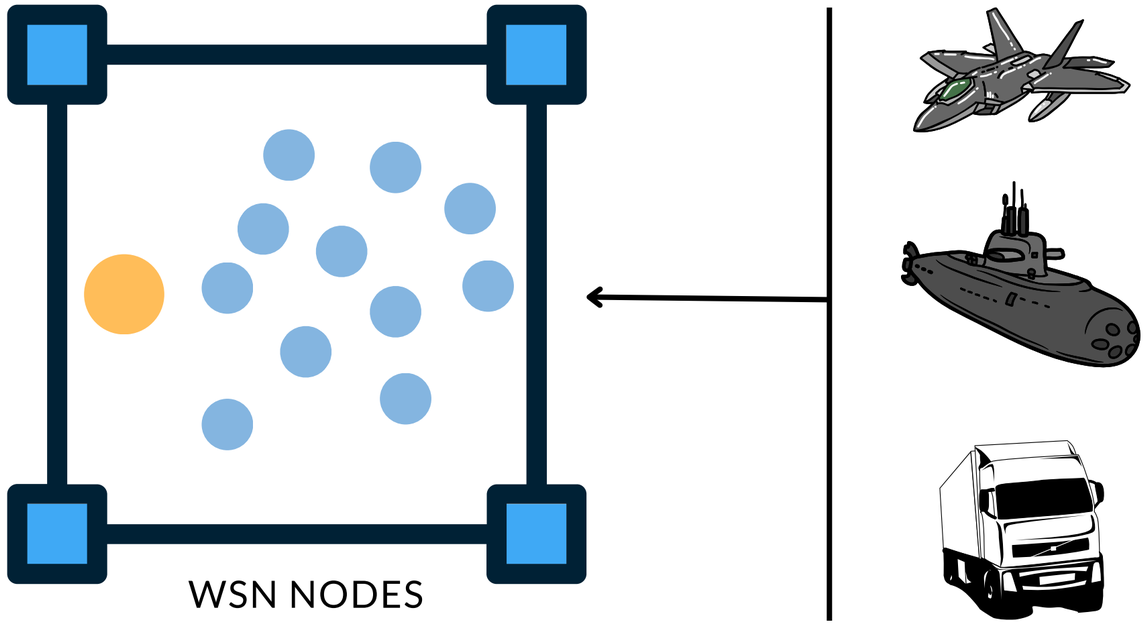

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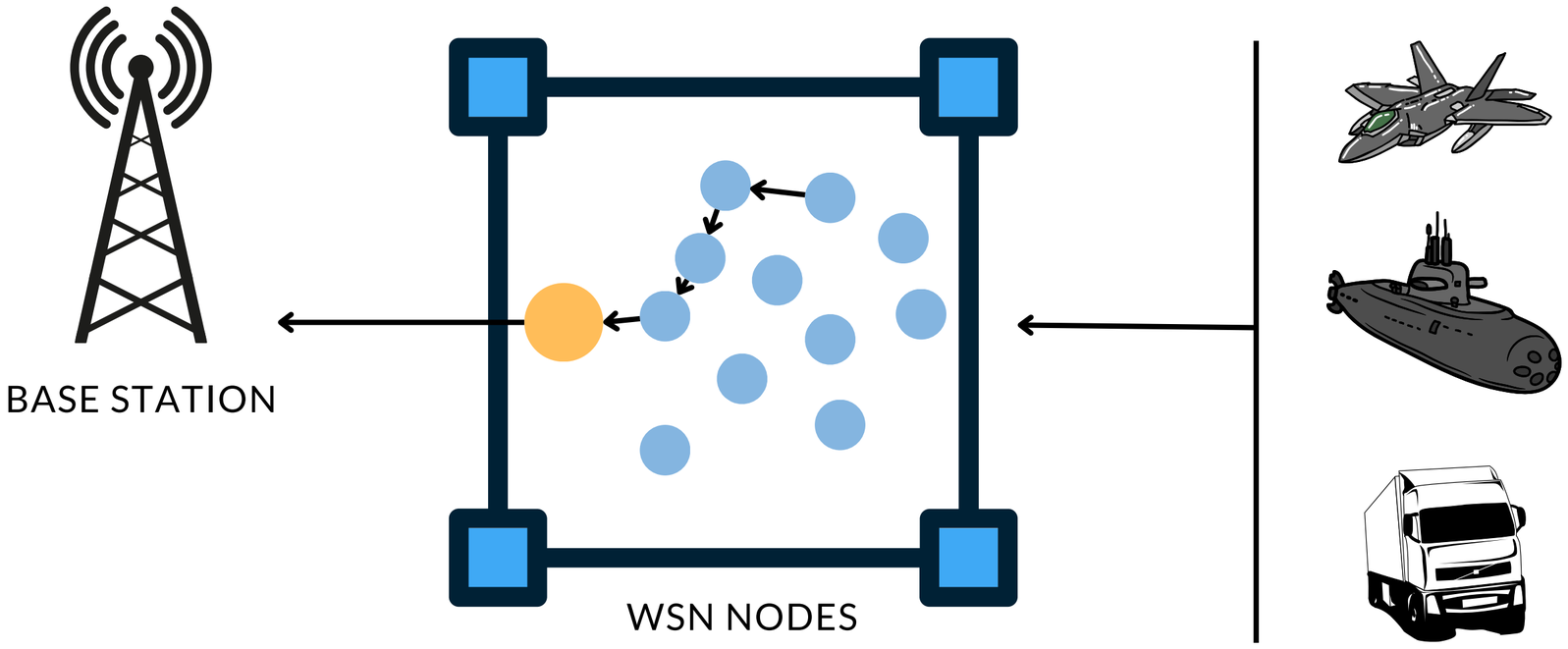
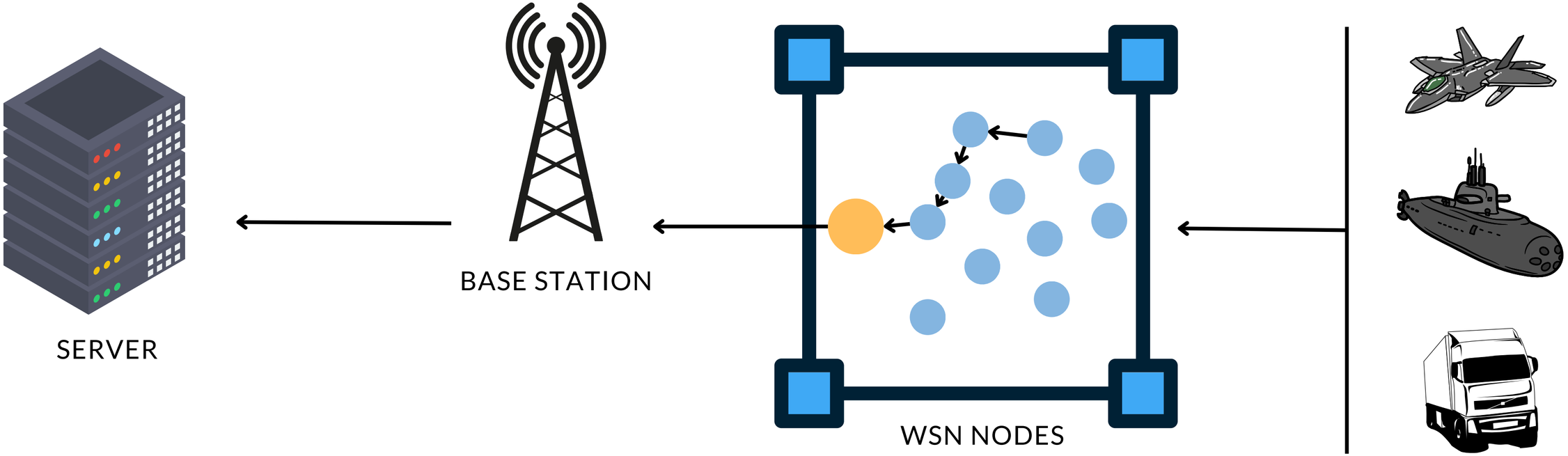
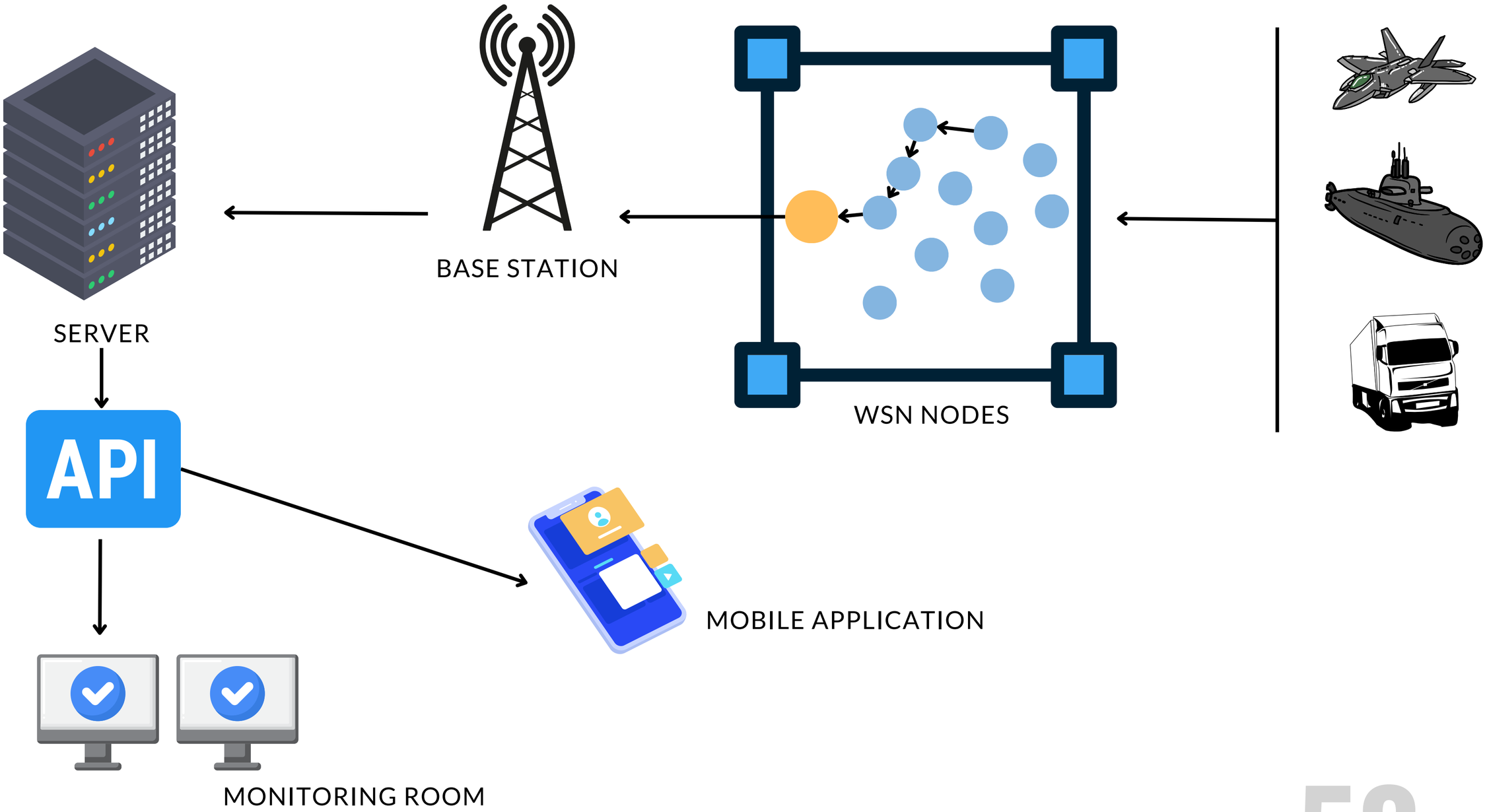

BASE STATION
WSN NODES


SERVER
BASE STATION
WSN NODES



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3/ / SELF-HEALING IN ROUTING VS CRYPTOGRAPHY

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	ROUTING	CRYPTOGRAPHY
Purpose	self-healing in wireless sensor networks refers to the ability of the network to automatically recover from failures in order to maintain network connectivity.	Self-healing in cryptography refers to the ability of cryptographic systems to recover from failures and maintain security
Mechanisms	Self-healing in wireless sensor networks, self-healing is achieved through mechanisms such as node redundancy and routing algorithms.	In cryptography, self-healing is achieved through mechanisms such as key backup and recovery
Scope	Self-healing in wireless sensor networks focuses on the overall health and functionality of the network.	Self-healing in cryptography focuses on the security of the data transmitted

3/ / SELF-HEALING IN ROUTING VS CRYPTOGRAPHY

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	ROUTING	CRYPTOGRAPHY
Triggers	self-healing in wireless sensor networks are typically network failures, such as node malfunctions or connectivity issues.	The triggers for self-healing in cryptography are typically security-related events, such as the compromise of a key.
Time frame	self-healing in wireless sensor networks may take longer, as the network needs to detect the failure and re-route data around it.	Self-healing in cryptography typically occurs quickly, within milliseconds or seconds

3/CRYPTOGRAPHY/POST-QUANTUM

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Hash-based signature

Code-based Cryptography

Multivariate Cryptography

Lattice-based Cryptography

-PQC-

POST-QUANTUM CRYPTOGRAPHY

3/CRYPTOGRAPHY/POST-QUANTUM

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Hash-based signature

Hash-based signature schemes use one-time signature schemes as their building block. A given one-time signing key can only be used to sign a single message securely. Indeed, signatures reveal part of the signing key.

Code-based Cryptography

The private key is associated with an error-correcting code and the public key with a scrambled and erroneous version of the code. Security is based on the complexity of decoding a generic linear code.

Multivariate Cryptography

This algorithm relies on the complexity of solving systems of multivariate polynomial equations.

Lattice-based Cryptography

Security is related to the difficulty of finding the nearest point in a lattice with hundreds of spatial dimensions (where each lattice point is associated with a private key) giving an arbitrary location in space (associated with the public key)

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Business Model Canvas — quantumsolutionsdz@gmail.com

Revision number: 005 — Date: 2023-06-07

1. Key Partners

1. Micro-controller producers like seed studio, and micro-computer producers like orange-pie.
2. Mass production from Foxconn or other production plants.
3. Amazon.com for mass selling and web-hosting servers.
4. Walmart for shelf renting and online sales.
5. Storage housing and stock renting facilities like Clutter.
6. Shipping partnership with FedEx, DHL, and UPS.

Existing Alternatives

No direct competitors in the market. only specialized companies.

4. Key Activities

1. Make sure our website is always active and up to date, also reply fast to customer problems in forums and in chat sections.
2. Make weekly/monthly challenges, advertising campaigns, and YouTube/social media videos regarding our products.
3. Try to make deals with large businesses and government agencies.

8. Key Metrics

1. Supply of ESP323 micro-controller boards with BT/WiFi.
2. Supply of sensors and cameras.
3. 3D printing for our packaging.
4. Supply of micro-computer boards with BT/WiFi.
5. International protection for our brand name, our kit solution patent, and our security patents.

3. Value Propositions

1. We provide an Easy of use and very convenient product that anyone can use by simply watching a 2 minutes video on their phone.
2. Our product is sold at a reasonable price to the customer as households are our primary customer base.
3. The main thing that we will provide is a mesh security system that has never been used commercially which will provide military-grade security to our customers.
4. We will sell security kits that contain multiple types of sensors that can be chosen depending on customer needs (Temperature/Humidity, Cameras, Smoke Motion, Noise, etc) .

9. Customer Relationships

1. Online help through our website using our chat room, email, and customer forums.
2. Premium customers get one-to-one with our agents over the phone.
3. For Our business and government clients provide them a maintenance warranty where our engineers provide fast on-site maintenance and replacement of parts.

5. Channels

1. Crowd sourcing/funding.
2. Large online stores libe Amazon, Newegg, Bestbuy, techdirect, aliexpress, souq, and many others.
3. Direct/Online sales through our online store.
4. Distribution networks and retailers like supermarkets, electronics stores, and security stores.

2. Customer Segments

1. The general public (households/ farmers / small businesses).
2. Establishments governments/privates.
3. Military/Security agencies.
4. Hobbyists and Instructables.
5. On-demand sites and special case builds.
6. Schools and educational establishments.

Early Adopters

With crowd-sourcing, we plan to send our first batch of sales to interested customers for feedback on the quality, usability, and early problems.

7. Cost Structure

1. Web/Cloud Hosting services mainly from amazon.
2. Advertisements and publicity costs.
3. Outsourcing production.
4. Purchases of ESP32 boards, micro-computers, and sensors.
5. Renting storage facilities.
6. General administrative costs.

6. Revenue Streams

1. Kistarter programs for initial funds. 2. 20% to 30% of shares might be exchanged for funds to increase production. 3. Online sales using our website. 4. Direct sales to wholesalers and on-land stores and shops like Carrefour and Walmart. 5. Sales through online retailers and stores like Amazon and others. 6. Subscription plans and fees. 7. Government/Business contracts. 8. Maintenance contracts for large businesses. 9. Patent licensing.

Made by Quantum solutions partners (Hadjazi Mohammed Hisham, Sahraoui Mohammed Taher Amine, Mletta Mohammed Mouncif, Djebbar Yehya) qslab.online.

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CONCLUSION.

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