

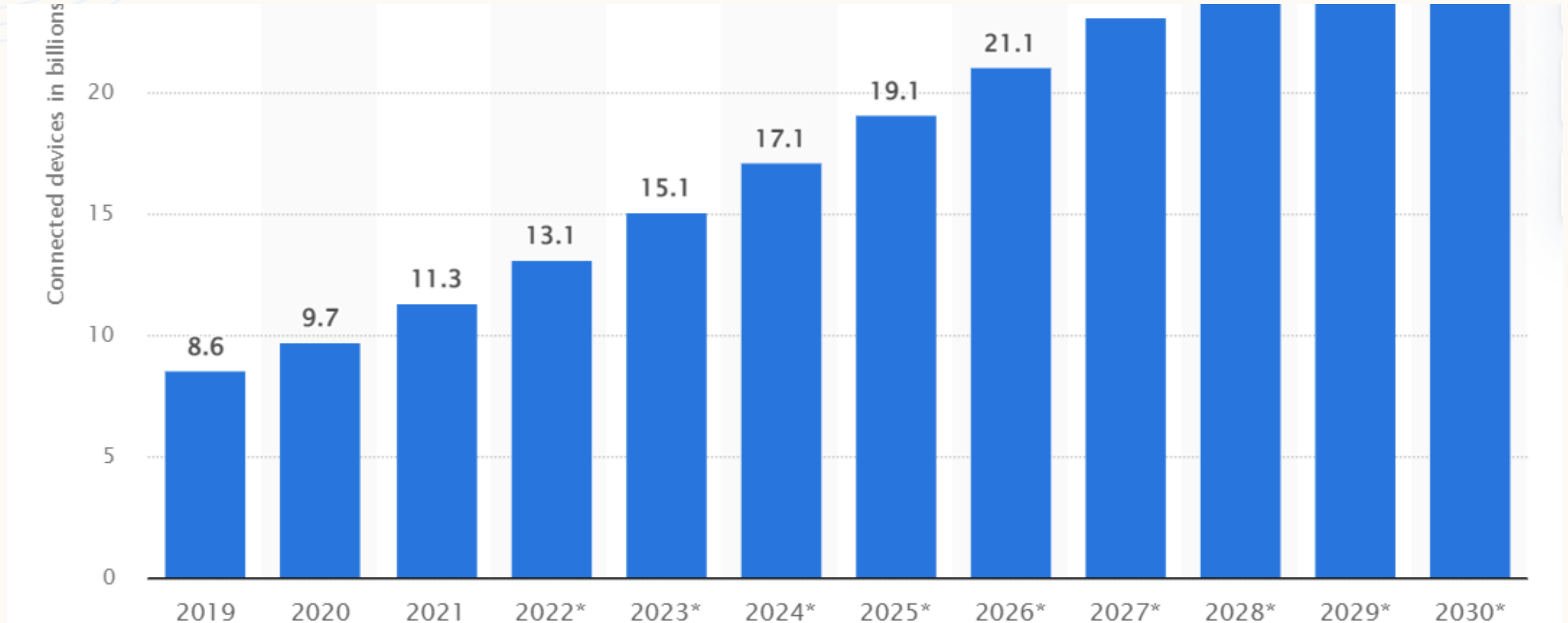
Content !

Check the clickable links as below to explore more .
This page was added

- Overview of IoT
- LPWAN networks.
- [Sigfox Connectivity In Kenya](#)
- [Converging into Sigfox.](#)
- Choosing cloud platforms.
- Microsoft Azure IoT Services.
- Interfacing Hardware with Sigfox
- [Creating IoT Resources in Azure](#)
- [Stream real-time in Azure Power Bi.](#)

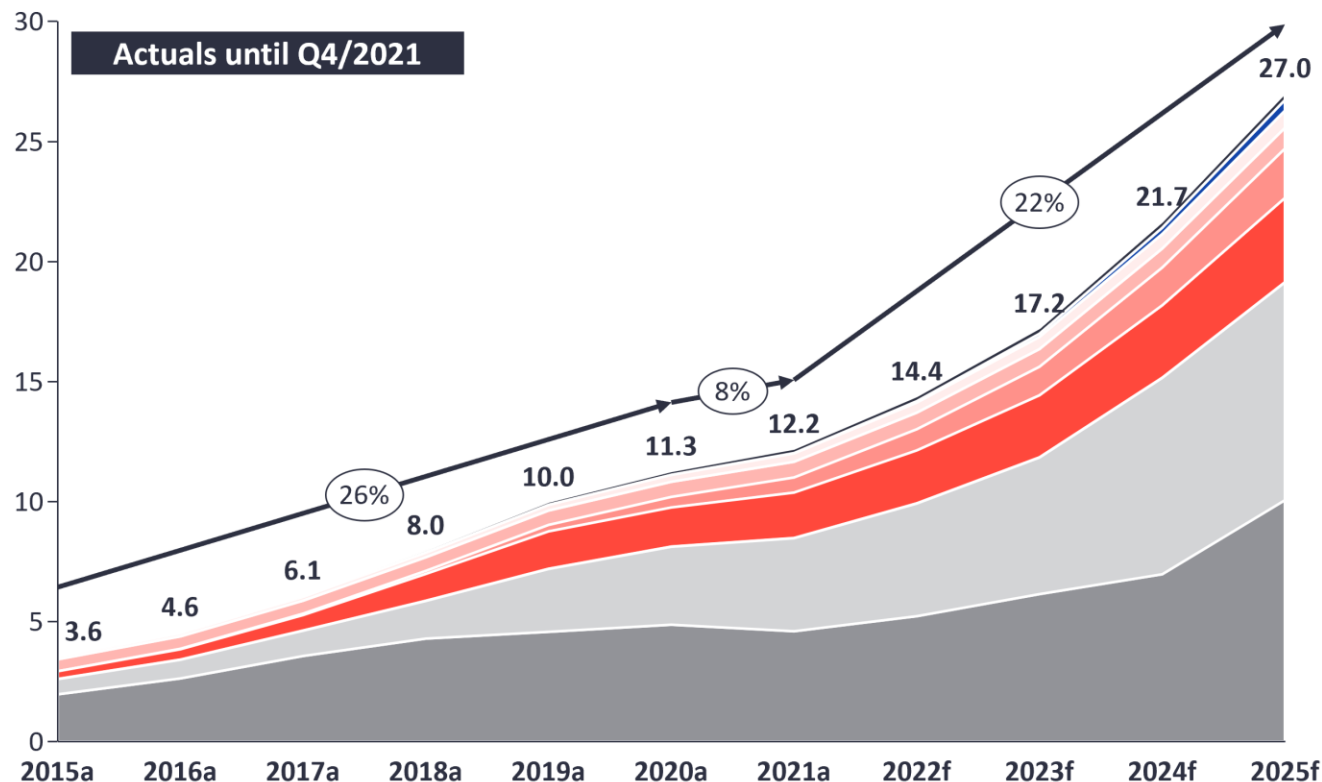
WHY IOT?

2



Global IoT Market Forecast [in billion connected IoT devices]

Number of global active IoT Connections (installed base) in Bn



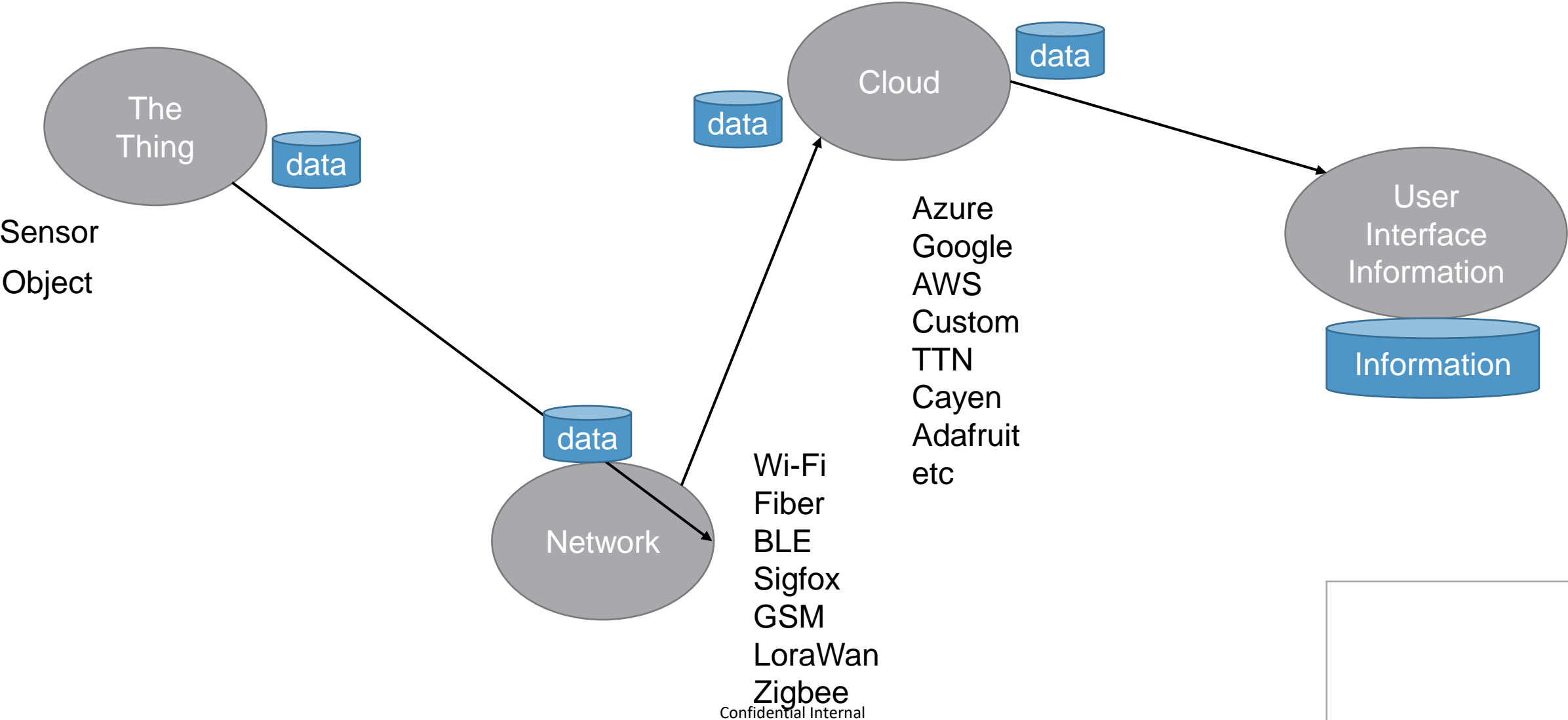
CONNECTIVITY TYPE	CAGR 20-21	CAGR 21-25
Wireless Neighborhood Area Networks (WNAN)	17%	11%
5G IoT	-	159%
Other	22%	20%
Wired IoT	4%	7%
LPWA	42%	34%
Legacy Cellular (2G/3G/4G)	16%	17%
Wireless Local Area Networks (WLAN)	19%	24%
Wireless Personal Area Networks (WPAN)	-6%	22%

XX% = CAGR

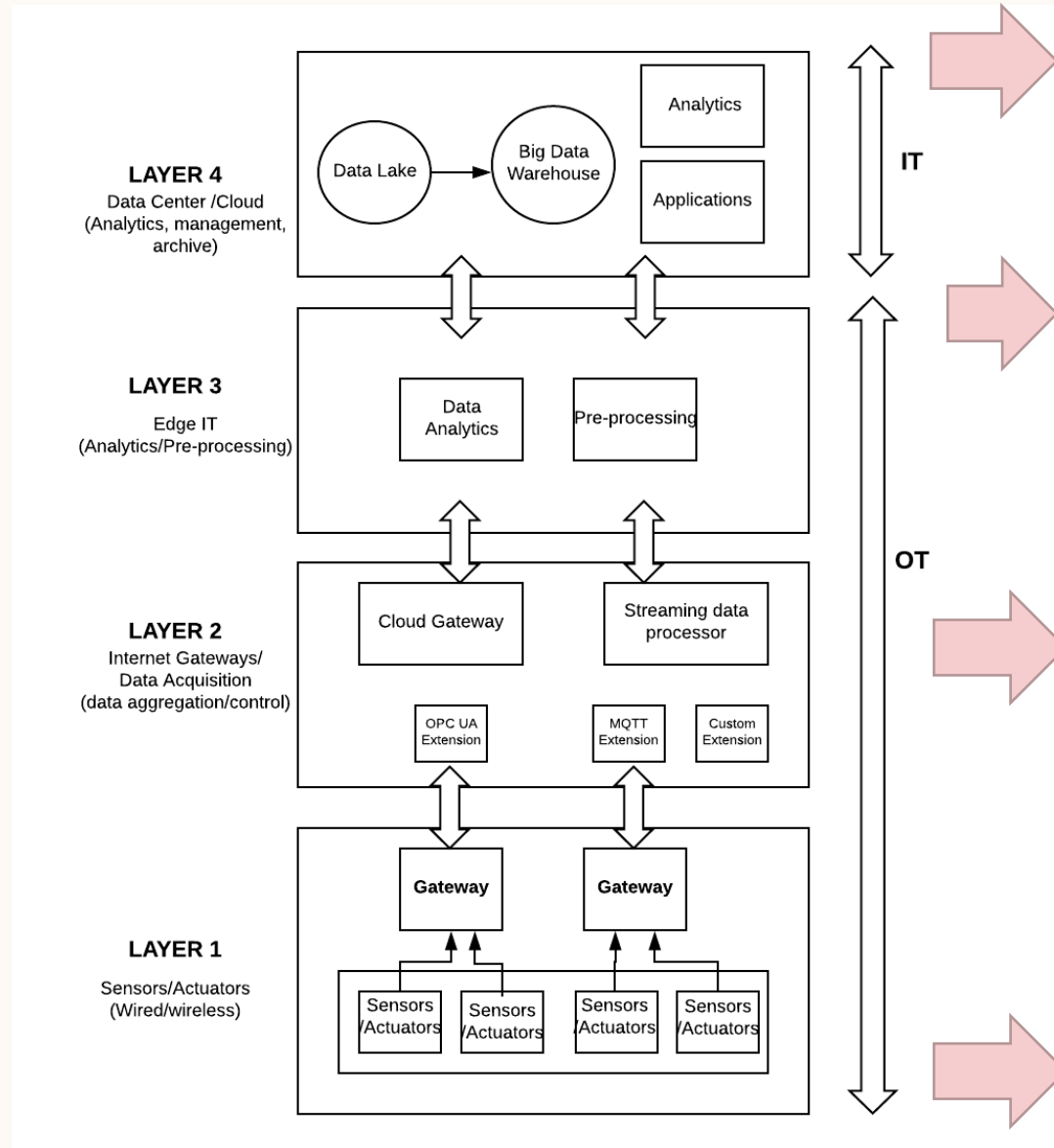
Note: IoT Connections do not include any computers, laptops, fixed phones, cellphones or tablets. Counted are active nodes/devices or gateways that concentrate the end-sensors, not every sensor/actuator. Simple one-directional communications technology not considered (e.g., RFID, NFC). Wired includes Ethernet and Fieldbuses (e.g., connected industrial PLCs or I/O modules); Cellular includes 2G, 3G, 4G; LPWAN includes unlicensed and licensed low-power networks; WPAN includes Bluetooth, Zigbee, Z-Wave or similar; WLAN includes Wi-fi and related protocols; WNAN includes non-short range mesh, such as Wi-SUN; Other includes satellite and unclassified proprietary networks with any range.

Source: IoT Analytics Research 2022. We welcome republishing of images but ask for source citation with a link to the original post and company website.

Quick intro of IoT



Layers of IoT and Opportunities



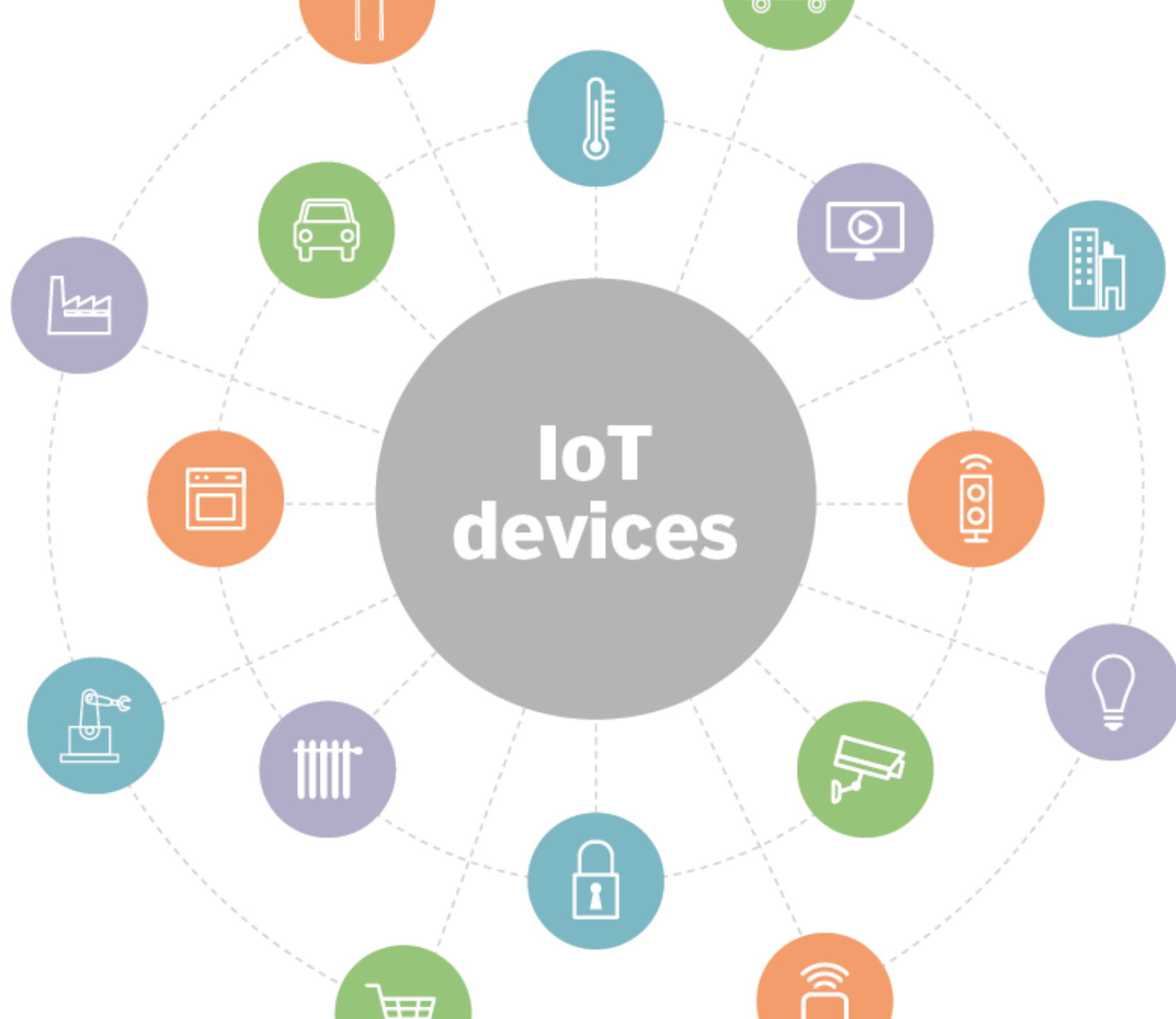
- IoT Engineer s
- General Data Engineers
- ML experts
- Devops Engineers
- Cloud practitioners
- Big Data experts.

Solution Engineers

- IoT Engineers
- Network Engineers
- IT Support

Or
Solution Architects.

- IoT Engineers
- Firmware Engineers
- Embedded systems Engineer
- PCB Engineers
- R&D engineers
- Embedded Engineers
- R&D engineer



Device Makers

Background

- Electrical and electronic Engineering
- Computer Engineering
- Mechatronic Engineering
- Passion driven Individuals

Skills:

- Good understanding of Electronics
- Strong understanding of PCBs
- Knowledge of RF and analog layouts

Requirements

- PC
- Software –
Altium, Kicad,
Eagle, Orcad

Cloud ... ?



- [Microsoft Azure](#) -MQTT,AMQP,HTTP and HTTPS
- [AWS](#) -MQTT,HTTPS,MQTT over websockets
- IBM Bluemix – MQTT,HTTPS,MQTT
- [Thingwrox](#) -MQTT,HTTPS,MQTT,AMQP

IoT Protocol Connection models

- There is no set pattern for data routing, and the communication is highly dependent on the network topology

1

Device – to- Device
(BLE, ZigBee, G, Wifi)

2

Device – to- Gateway
(LPWAN, Wi-Fi)

3

Device – to- Data
(BLE, LoRaWan)

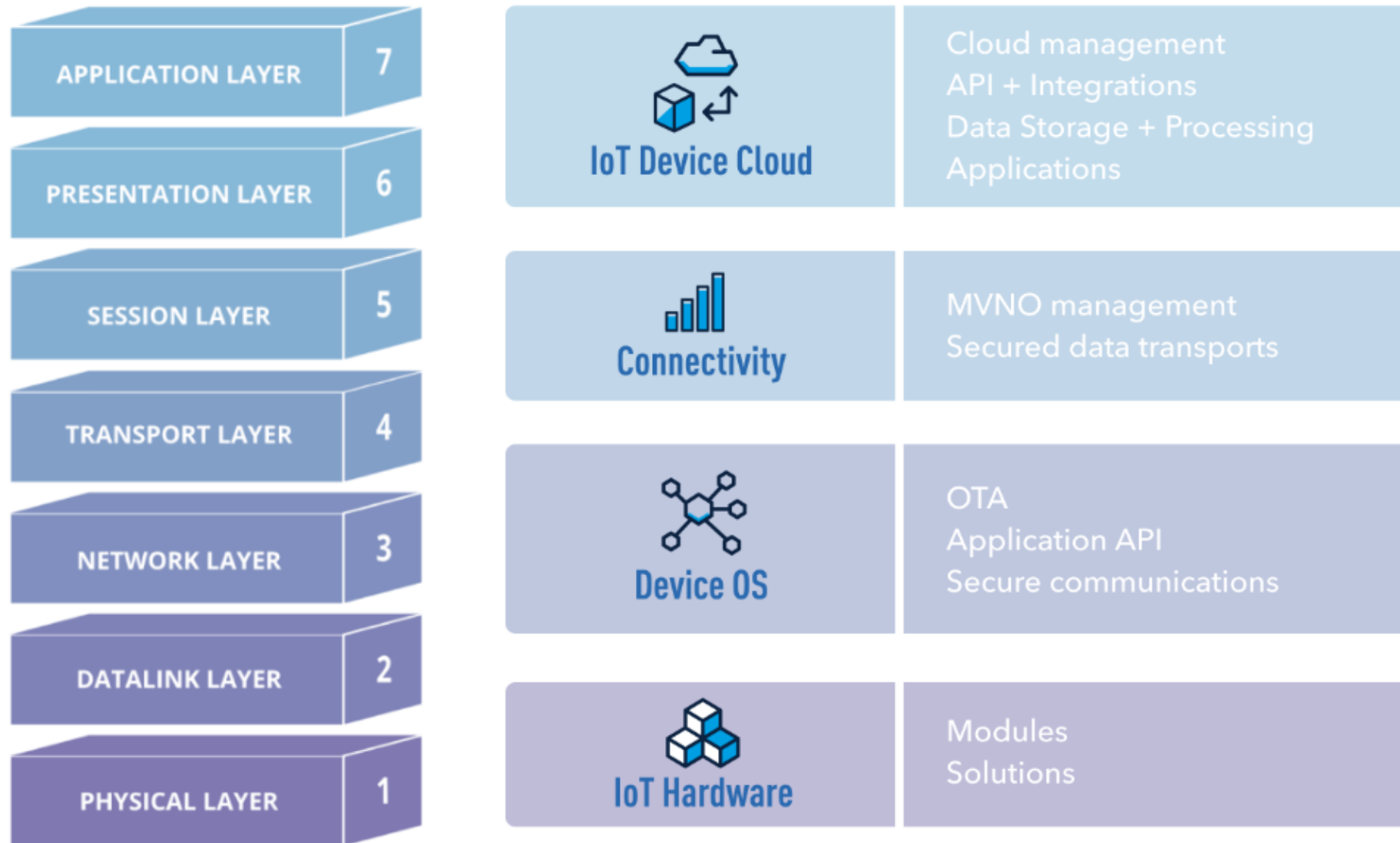
4

Gateway-to-Data
OAS

5

Communication between Data
(iot data protocols)

IoT Protocol Stack



ALL

PEOPLE

SEEM

TO

NEED

DATA

PROCESSING

IoT Protocol Broad Category

IoT data protocols that have **presentation** or **application layers** and network protocols for IoT - datalink and physical layers:

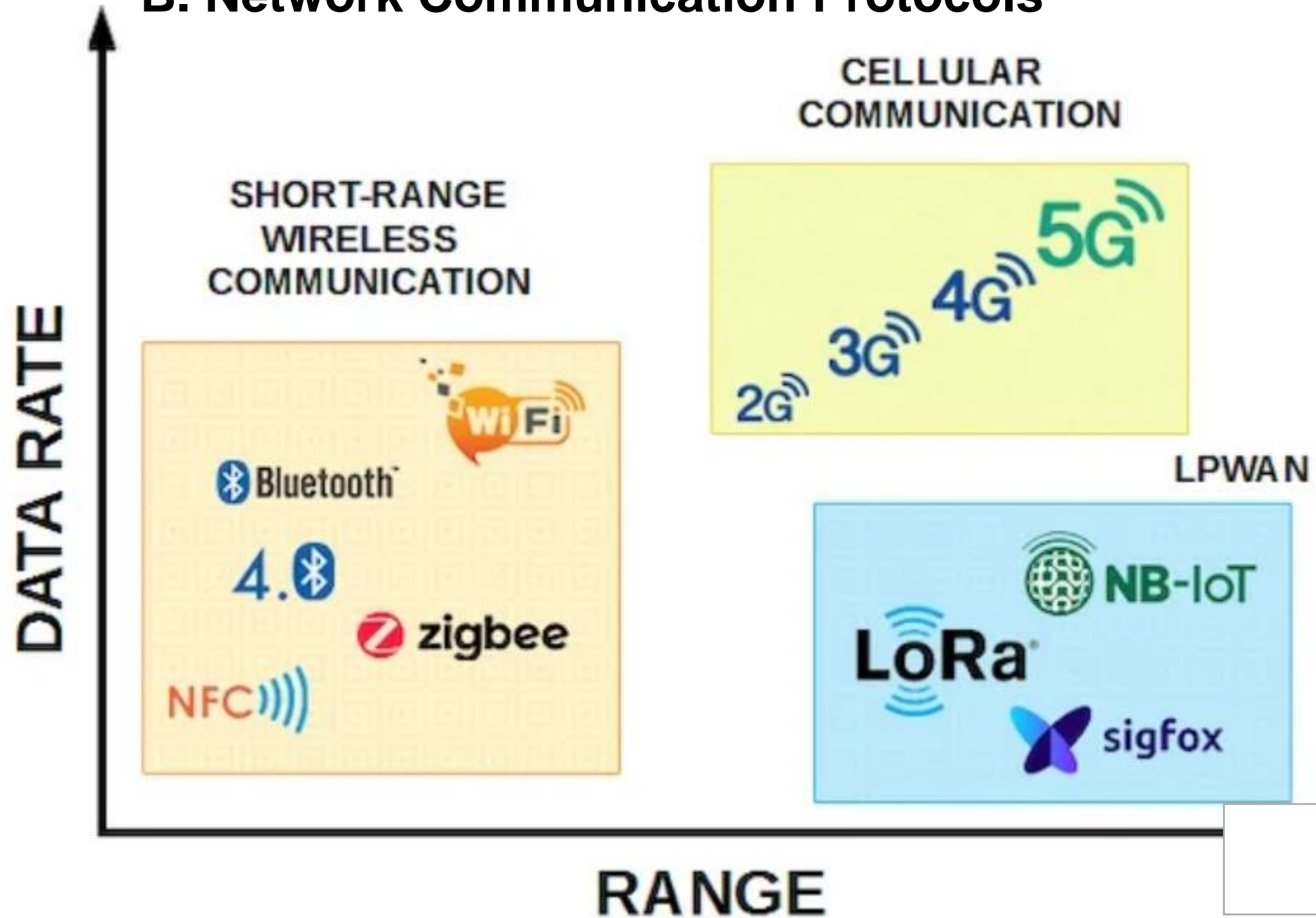
IoT Data Protocols

- AMQP
- MQTT
- HTTP
- CoAP
- DDS
- LwM2M
- .
- .

IoT network protocols

- Wi-Fi
- LTE CAT 1
- LTE CAT M1
- NB-IoT
- Bluetooth
- ZigBee
- LoRaWAN
- Sigfox

B. Network Communication Protocols



LPWAN PROTOCOLS



LoRaWAN – allows IoT devices to communicate over larger distances with minimum battery usage. It's RF carrier signal based in PHY layer of the telecom's device.

- Unlicensed Band
- 5km – urban areas,
- 15km – rural areas.
- Uncellular



Sigfox – LPWAN, 12 bytes UL, 8byte DL protocol.

- 10km – urban areas
- 40km – rural areas.
- Unlicensed band
- Uncellular



NB-IoT – this is a radio technology dvpd by 3GPP.

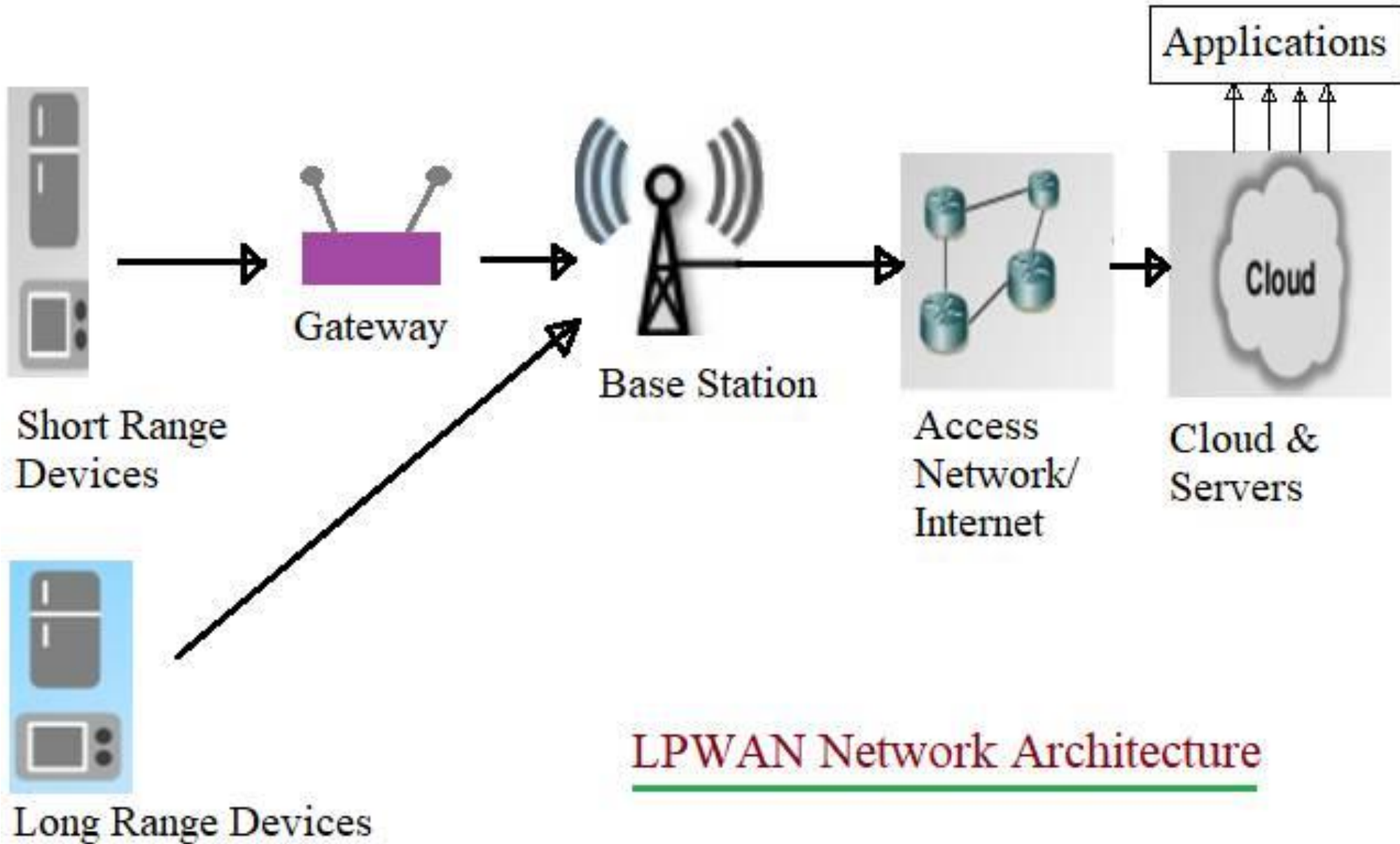
- Cellular
- Licensed band
- 10km range or less



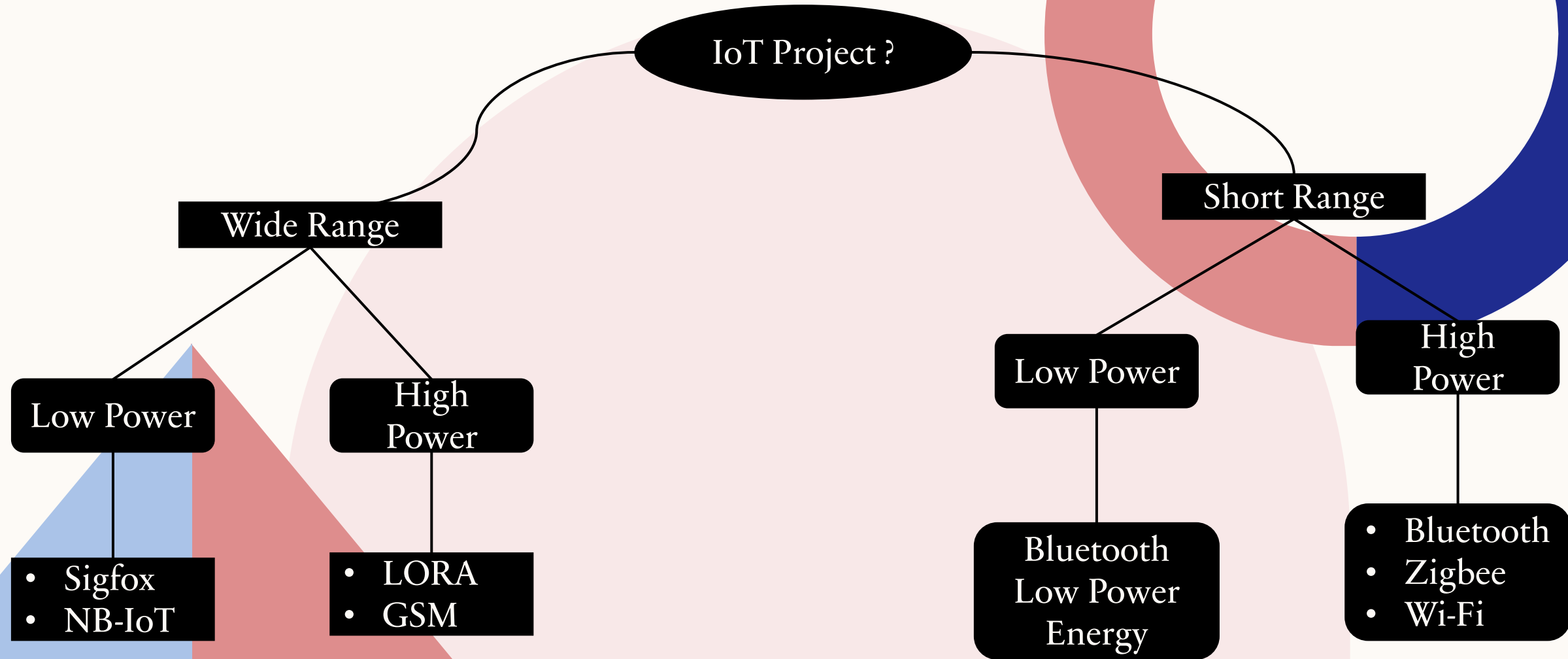
LTE-M – It's LPWAN developed by 3GPP. It's low latency and can support voice.

- Licensed
- Cellular
- Depends.

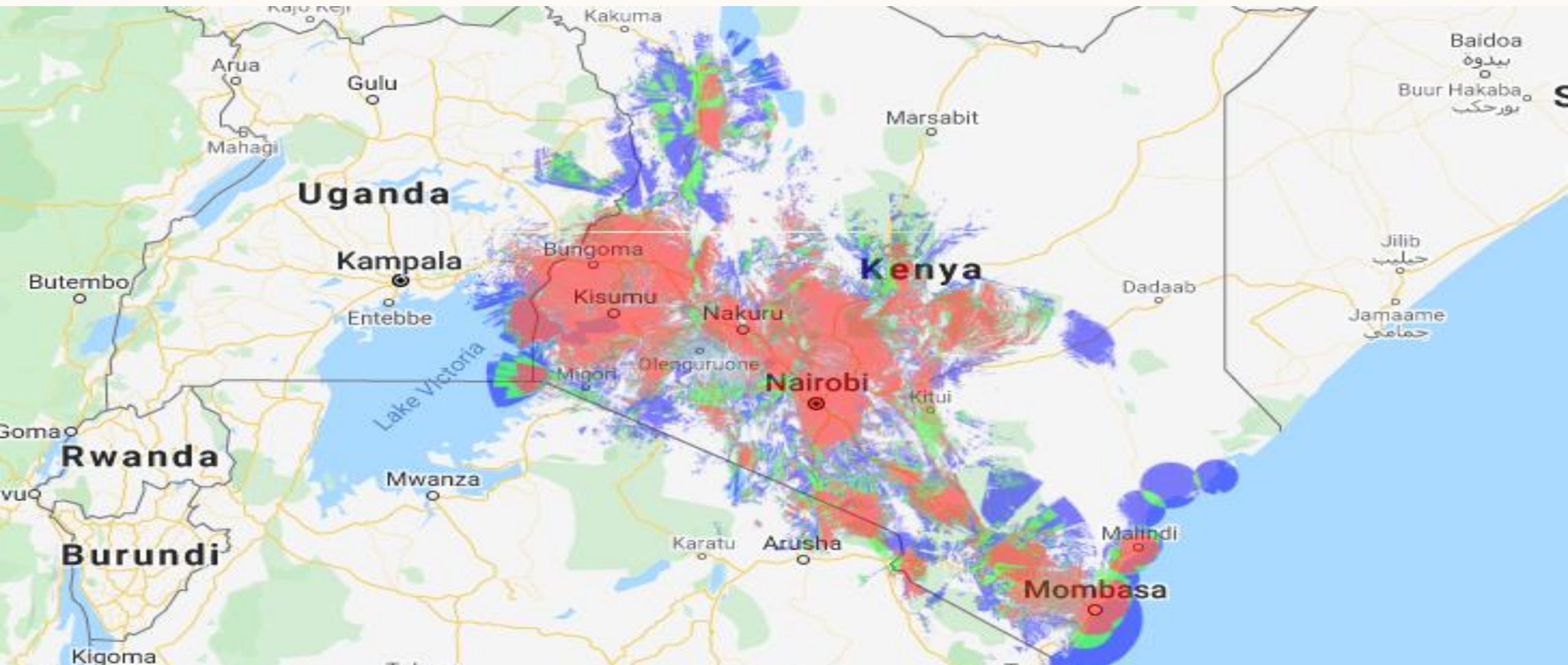
LPWAN Architecture



Internet of Things Technologies



Sigfox is covering 85% of Kenya's Population



Sigfox Unique Points



**Cost
Effective**



**Global
Reach**



**Low power
consumption**



**Wide
ecosystem**



**Anti-
jamming**



**Predictable
consumption**



Easy to deploy



**Indoor
penetration**



Security



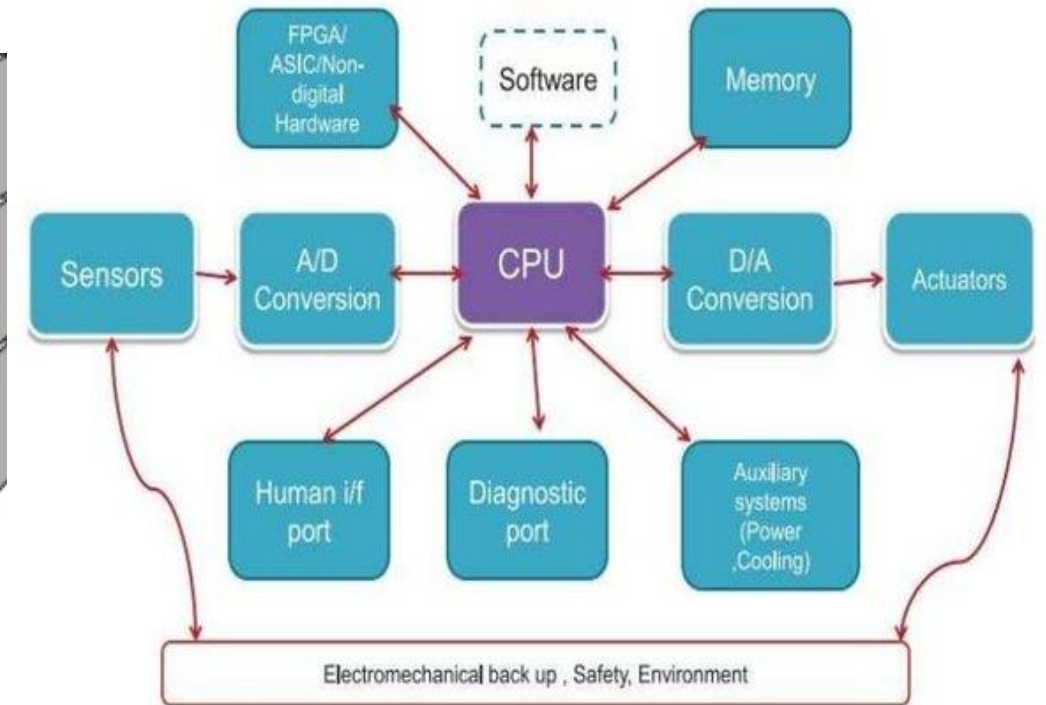
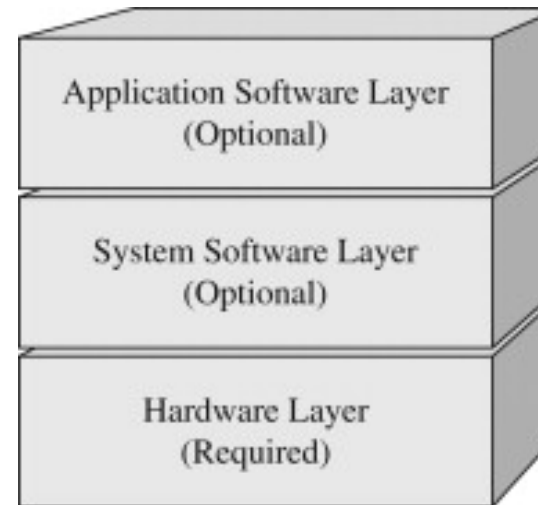
**Global
SLA**

The Embedded Systems Integration

All physical systems and application software layers (software located on and being processed by the embedded system) - Hardware, system software and application software

Key Concepts

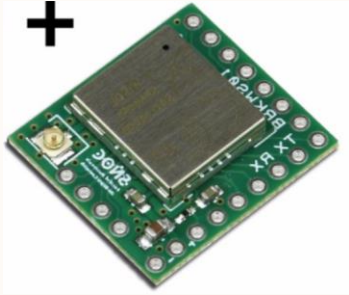
- Energy Source - Power Supply
- Inputs and Outputs - I/O
- Digital-Analog : ADC, DAC
- Hardware and firmware - interfaces and communication protocols



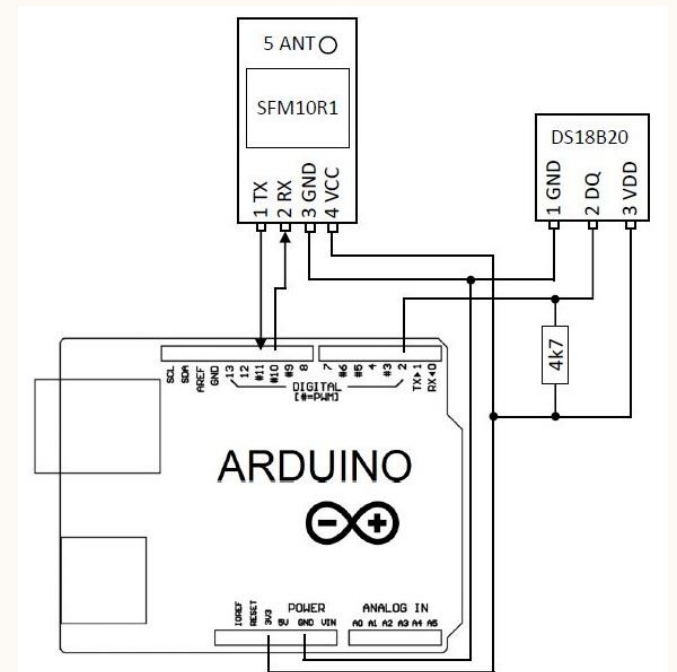
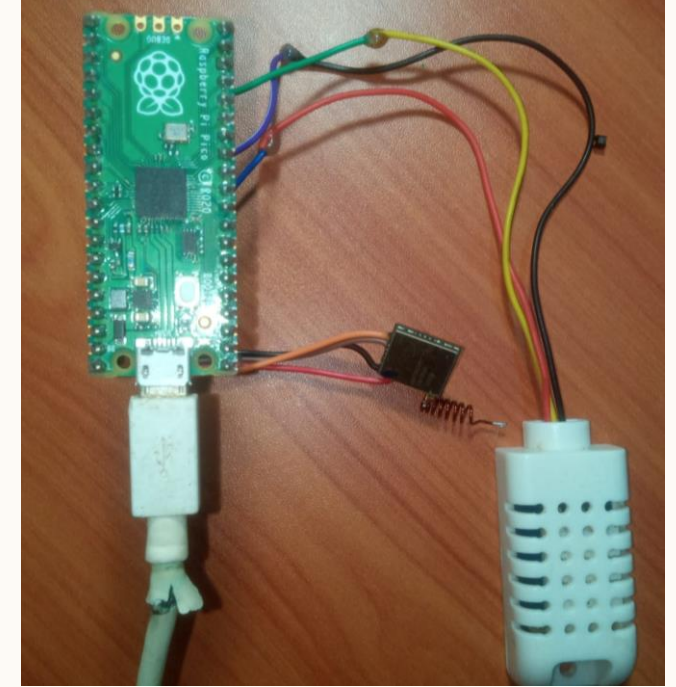
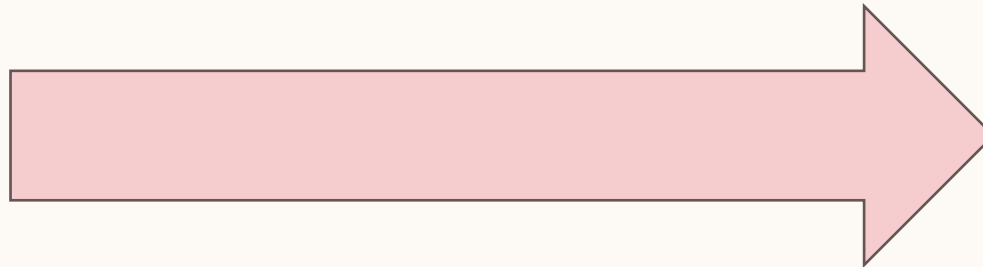
CHOOSING HARDWARE

Breakout board/ Radio module

+

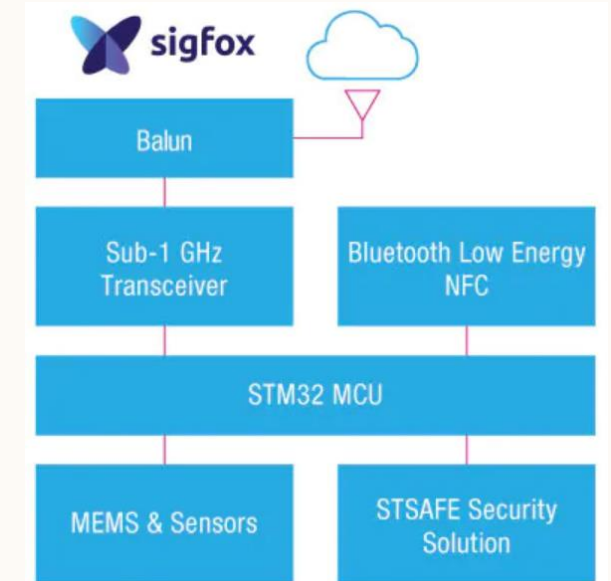


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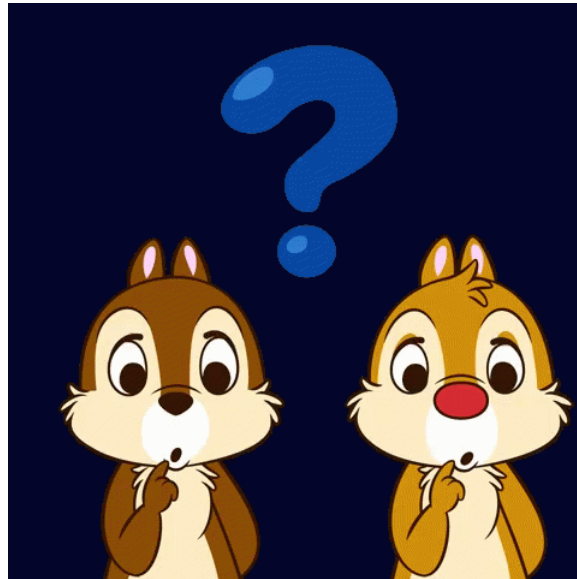
CHOOSING HARDWARE

Shield/Microcontrollers

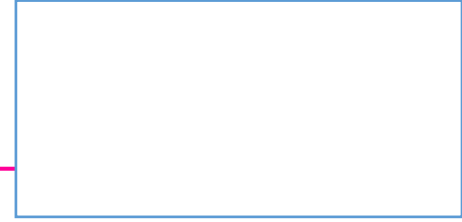


How do I integrate to my platform?

Where is the value? In the visualization



Callbacks & Sigfox



The callback – configured to a specific endpoint.

- The endpoint can be hosted by the application itself or by a third-party service.
- Once configured, messages are sent automatically to the receiving endpoint.

HTTP Head point

HTTPs Head point

MQTT broker

Email address,

The Message Format



```
{  
  "device": "56AB21",  
  "time": "time",  
  "data": "48494e50454f504c4520414d"  
}
```

Decode/Decrypt the Payload

- Each device comes with a **data sheet** that describes the structure of the **different data payloads** it sends/receives.
- Some Manufacturers will provide a paid description service

Now and Future Directions

24

Blockchain

IOT

AI/ML

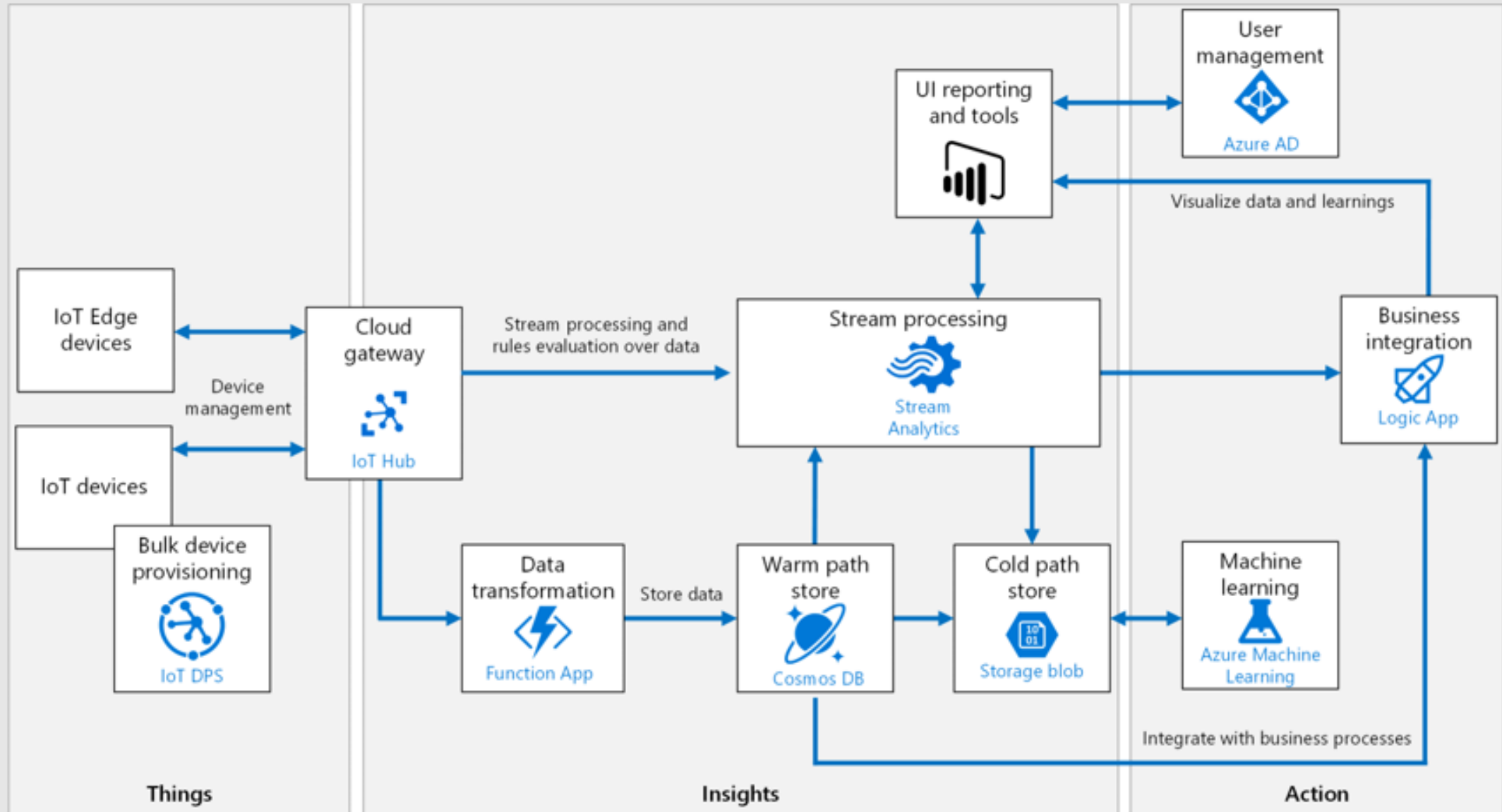
Embedded AI

Virtual Reality

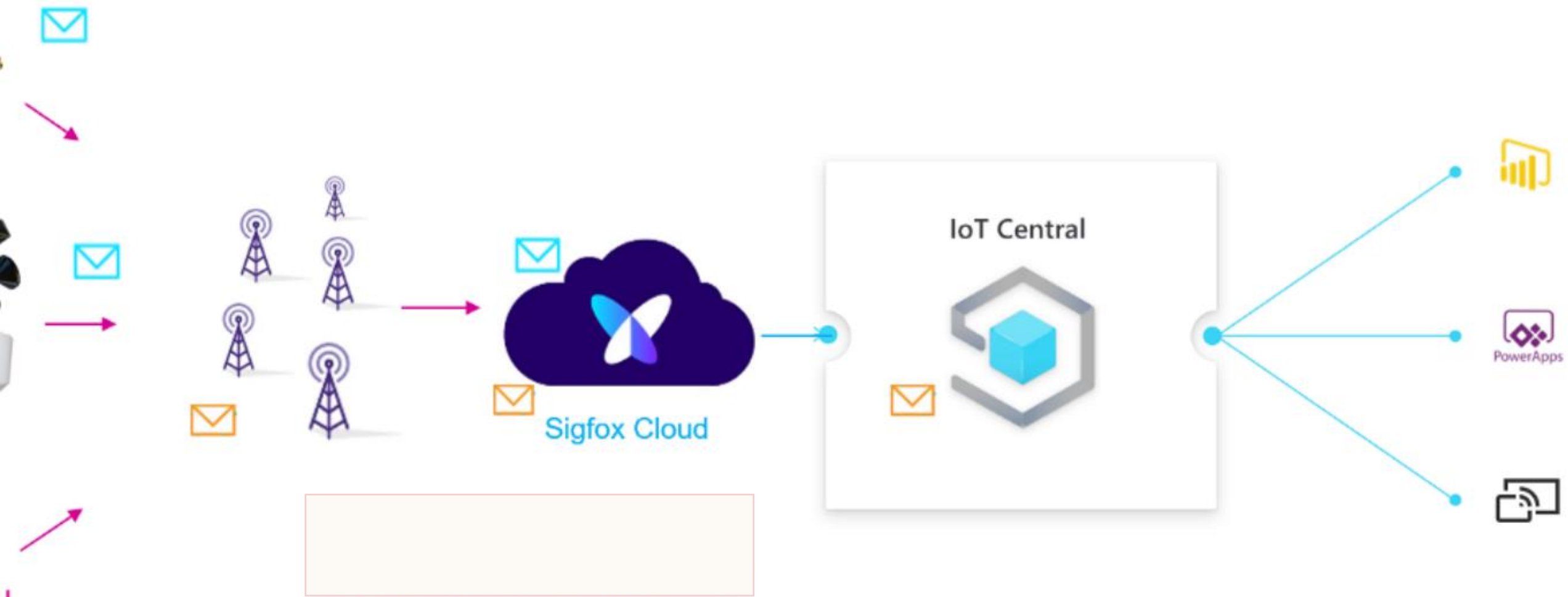
DEMO

- Create an End-to-End IoT Solution (LPWAN-AZURE) – today
- Send prompts after EDGE AI model has inferenced. (EDGEIMPULSE-LPWAN-SIGFOX)

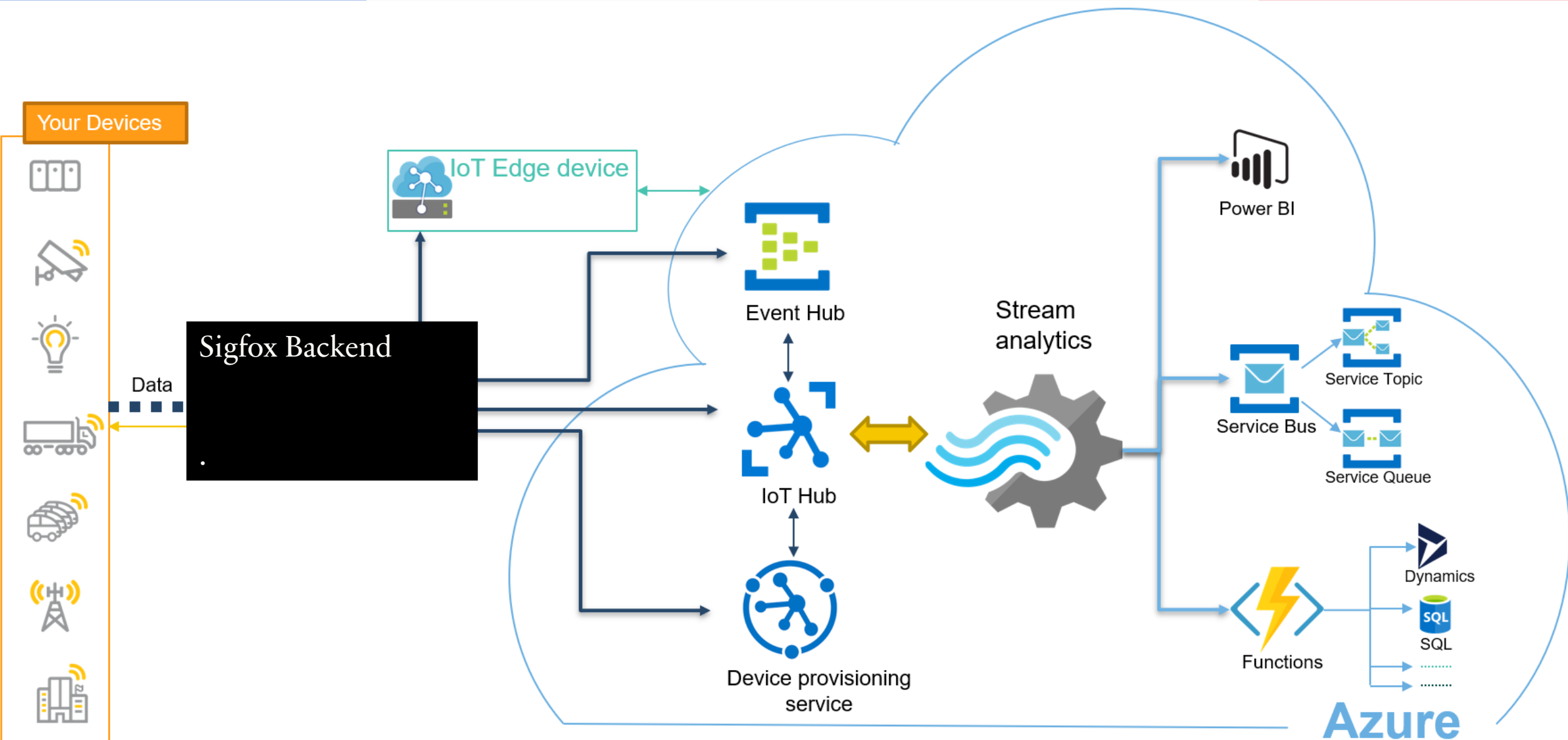
IoT Reference Architecture Azure IOT



IOT CENTRAL FLOW



Sigfox and Azure



THANK YOU



@aron_ayub



Aron Ayub