NECKO technologies

Industrial IoT in manufacturing industry

aws PARTNER Advanced Tier Services

Overview

1. Who are we ?
2. Introduction to the AWS cloud
3. Use case - IIoT and LoRaWAN
4. Conclusion

Who are we ?

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Nicolas Decruyenaere

- Master in Computer Sciences at UMONS
- Joined Necko Technologies in 2019

- AWS Solutions Architect
- AWS DevOps Engineer

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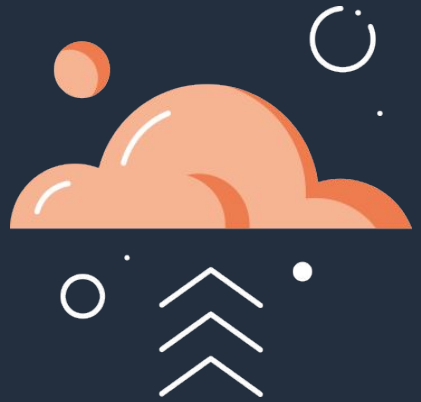
Necko Technologies

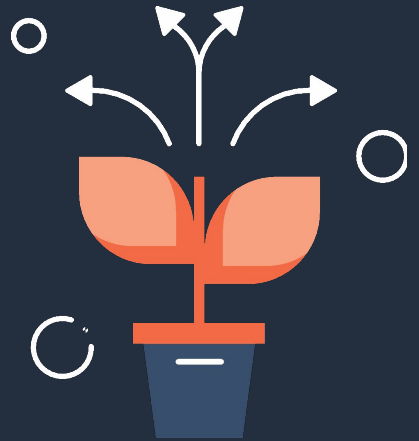
We support our customers through their journey to the cloud

Our service offer

Foundation



Migration



Optimisation

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In a few words

- Startup founded in 2017
- Located at Mons
- First Walloon AWS partner
- AWS WAR Partner

aws PARTNER Advanced Tier Services

- AWS Lambda Delivery
- AWS CloudFormation Delivery
- Well-Architected Partner Program

Prix Mercure 2018
Ville de Mons
Jeune Entreprise

lme la maison de l'entreprise

Inno pépites 2018
LME
Catégorie entreprise IT

AWS Service Delivery
AWS Lambda
AWS CloudFormation

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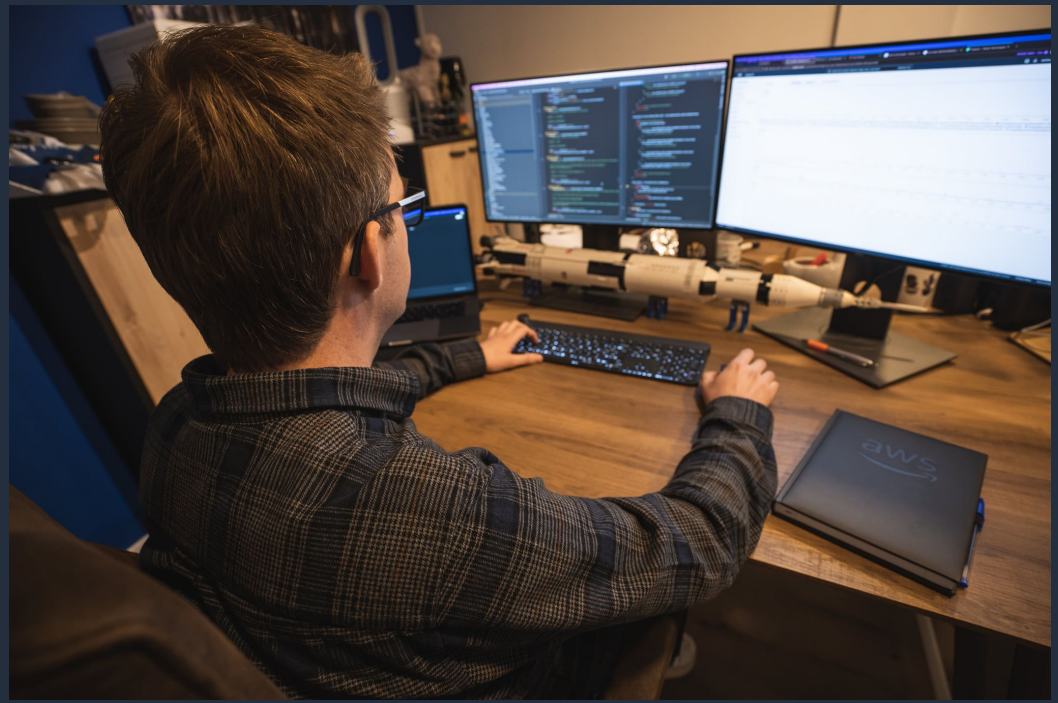
The team

- 14 Neckocos… for now (still recruiting)
- Over 70 AWS certifications
- Very specifically skilled profiles

Environment



git

GitHub

JET BRAINS

TS

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Trainings

Our customers

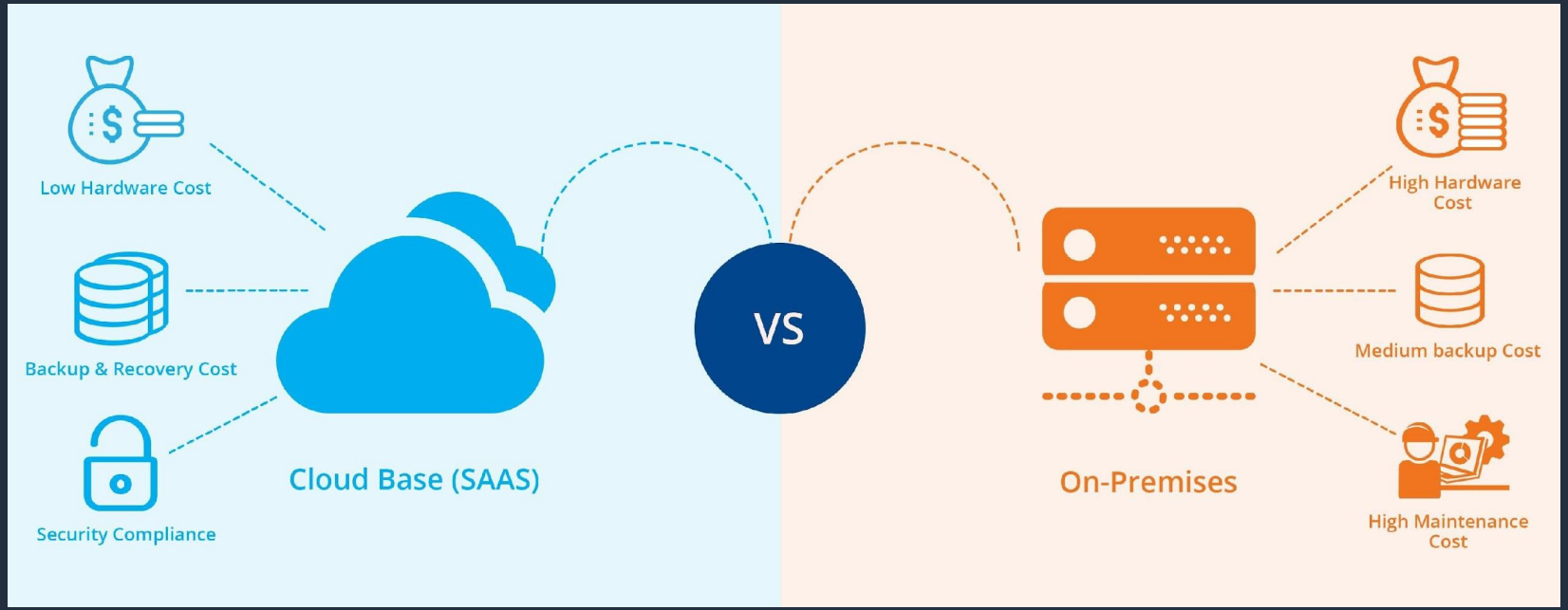
AWS Cloud

Cloud computing

Cloud computing is the ability to get computer resources on demand from internet based on a “pay as you go” tarification.

source: https://aws.amazon.com/fr/what-is-cloud-computing/

Cloud vs On-Premises



Local servers = problems

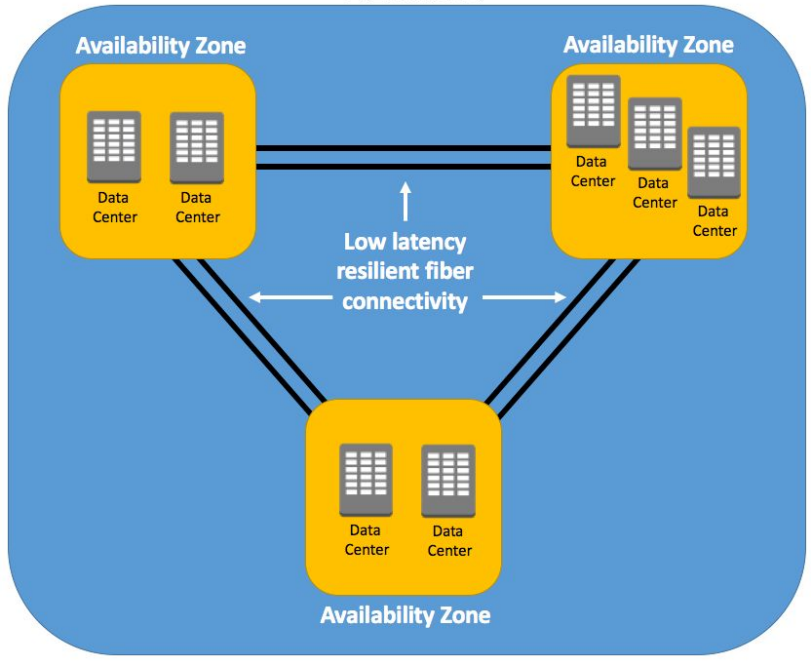
Amazon Web Services

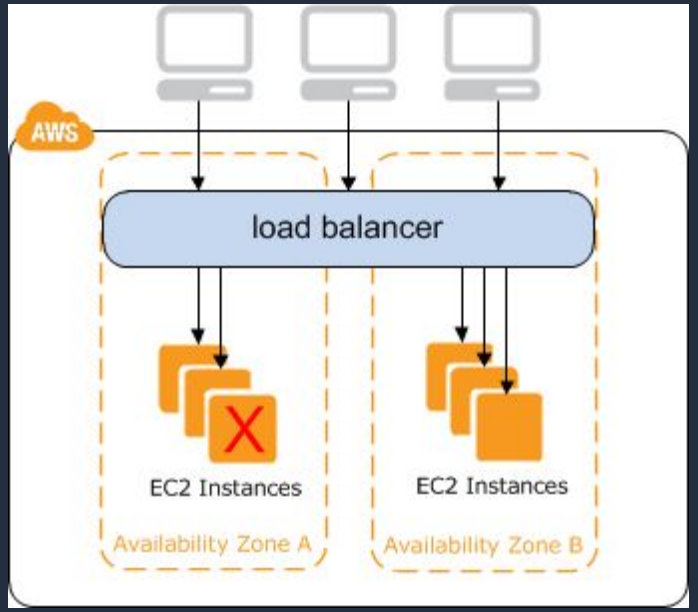
- No initial costs
- Pay as you go
- Automatic scaling
- Infrastructure self-service

AWS leader for 14 years

AWS Global Infrastructure

Regions divided in Availability Zones





From on-premise to serverless

Infrastructure

Container services

Managed Service

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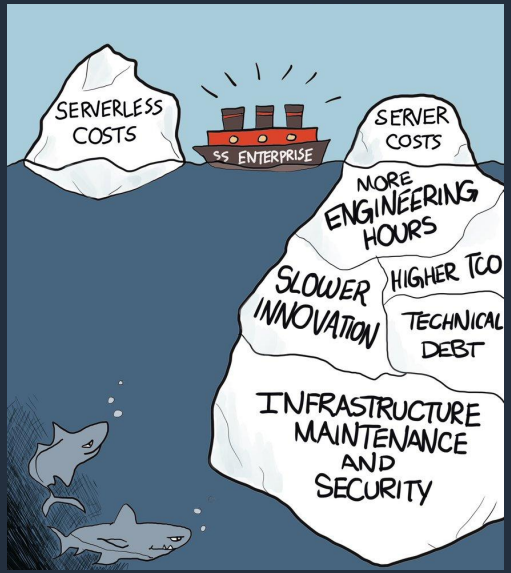
Managed services = Serverless

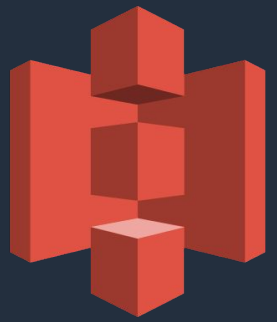
- Pay per use
- Reliability
- Alerting focused on customer solution
- Micro services



AWS – Some services

AWS – Some services

Simple Storage Service (S3)



- Object storage service
- Versioning
- Encryption
- Lifecycle rules
- …

AWS – Some services

Identity and Access Management (IAM)

- Manage access to AWS resources
- Roles
- Policies
- Least-privilege access/fine-grain permissions
- …

AWS – Some services

AWS Lambda

- Run code serverless
- Event-driven
- Scaling
- …

AWS – Some services

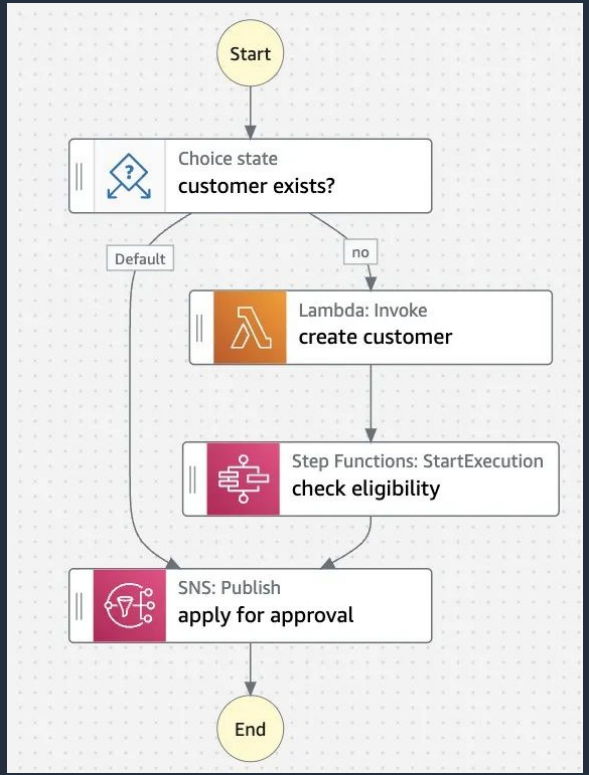
AWS DynamoDB

- NoSQL database
- JSON interface
- Access in ms
- …

AWS – Some services

AWS Step Functions

- State machines
- Workflow visualization tool
- Works with lambdas, AWS API calls, …
- …



From ClickOps...

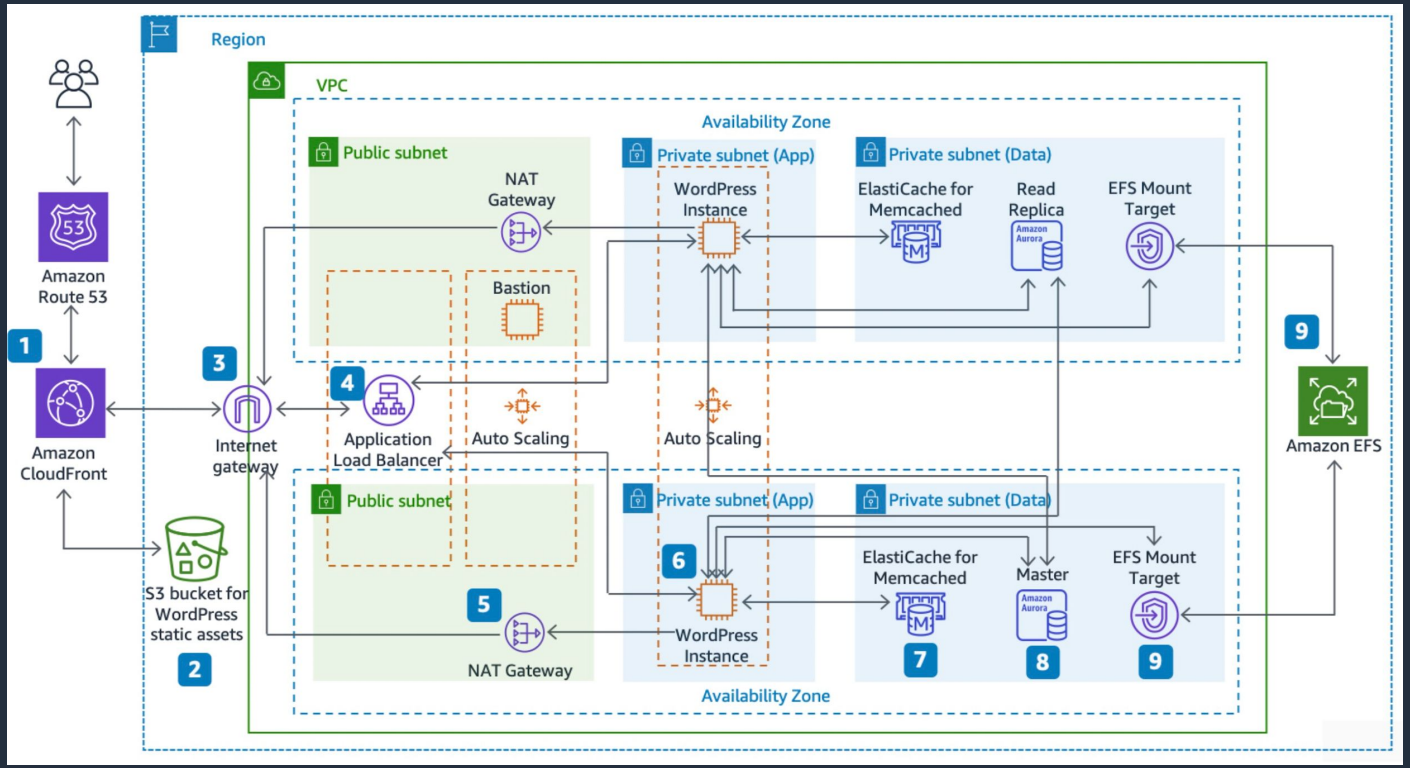
ClickOps ?

It’s adventure time !

Problems ?

Problems ?

Problems ?


Region
VPC
Availability Zone
Public subnet
NAT Gateway
Bastion
Private subnet (App)
WordPress Instance
Private subnet (Data)
ElastiCache for Memcached
Read Replica
EFS Mount Target
Amazon Route 53
Amazon CloudFront
Internet gateway
Application Load Balancer
Auto Scaling
Auto Scaling
Amazon EFS
S3 bucket for WordPress static assets
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ElastiCache for Memcached
Master
EFS Mount Target
WordPress Instance
NAT Gateway
Availability Zone
1
2
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8
9
9

Problems ?

- Time consuming
- Not easily reproducible
- No global vision of the infrastructure
- No scaling
- ...

Benefits ?

Benefits ?

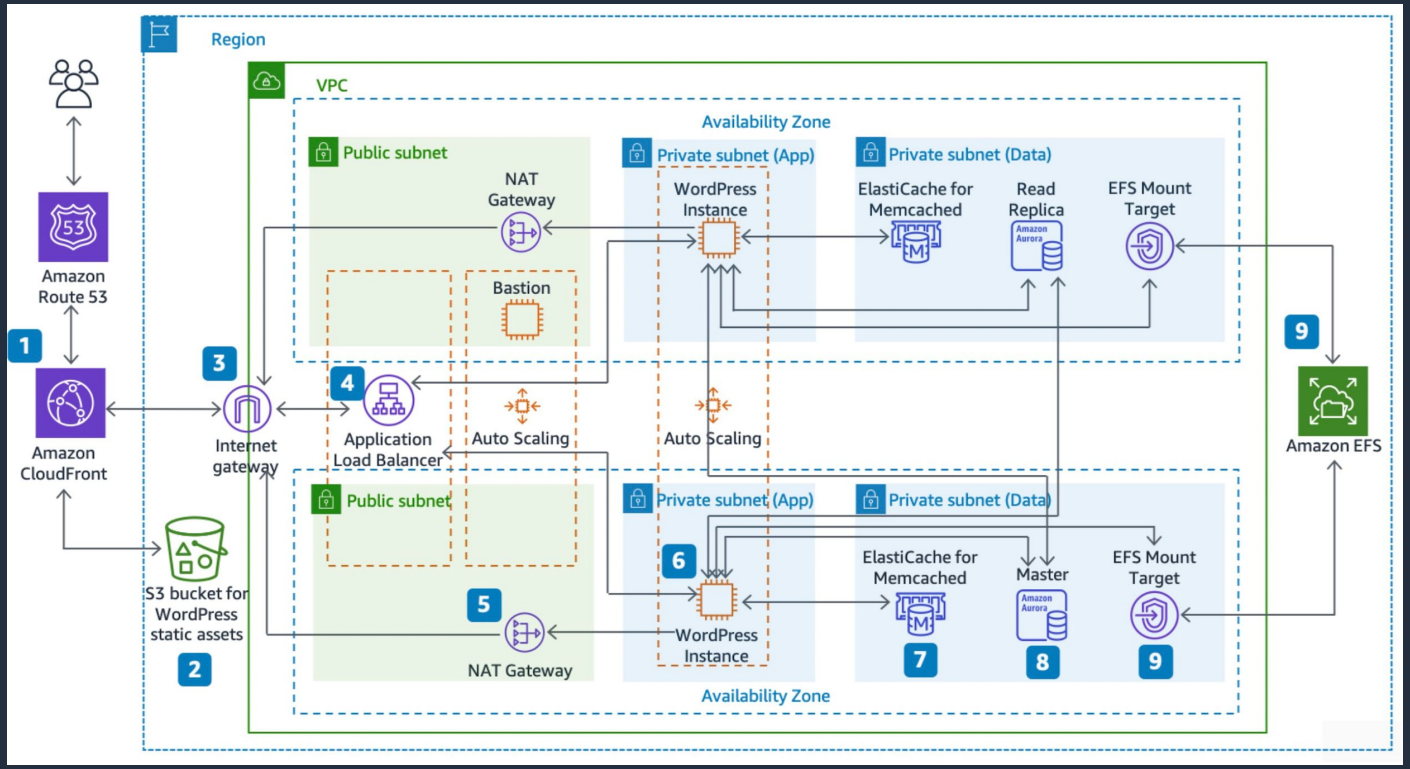
- Easy to test an idea
- Useful to learn a new service

… To DevOps

DevOps ?

Unify application development and infrastructure management

DevOps ?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Infrastructure as code

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Infrastructure as code

- Instead of building the infrastructure, give AWS a template of what you want so it builds it for you

Infrastructure as code

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- Global vision

Infrastructure as code

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- Versioning

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- Versioning
- Reproducible/consistency at scale

Infrastructure as code

- Instead of building the infrastructure, give AWS a template of what you want so it builds it for you
- Global vision
- Versioning
- Reproducible/consistency at scale
- CI/CD integration
- ...

Infrastructure as code

- Instead of building the infrastructure, give AWS a template of what you want so it builds it for you
- AWS Cloudformation

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- Stacker, Sceptre, AWS SAM, Serverless Framework, ...

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- Terraform

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- AWS CDK

AWS CDK

- High-level object-oriented framework

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- Open-source (https://github.com/aws/aws-cdk)

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- Multiple language support : Javascript, Typescript, Python, Java, C#, Go

AWS CDK

- High-level object-oriented framework
- Open-source (https://github.com/aws/aws-cdk)
- Multiple language support : Javascript, Typescript, Python, Java, C#, Go
- Synthetizes Cloudformation templates

AWS CDK

How does it work ?

AWS CDK

How does it work ?

- App
  - Stacks
    - Constructs

AWS CDK

```
import {App, Stack, StackProps} from 'aws-cdk-lib';
import * as s3 from 'aws-cdk-lib/aws-s3';

class HelloCdkStack extends Stack {
    constructor(scope: App, id: string, props?: StackProps) {
        super(scope, id, props);
        // Something
    }
}

const app = new App();
new HelloCdkStack(app, "HelloCdkStack");
```

AWS CDK

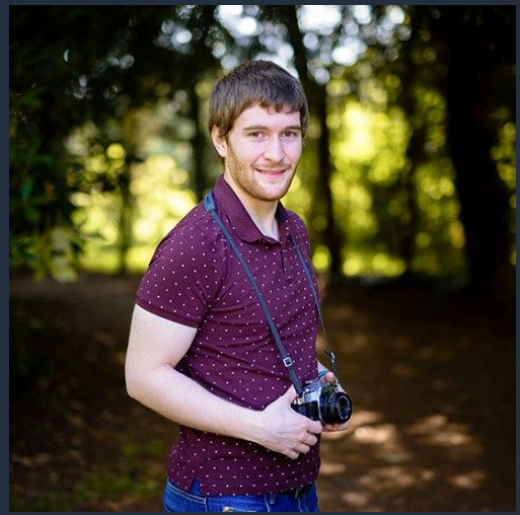
It’s adventure time !

Use case - IIoT LoRaWAN

Maximilien Charlier

- PhD in Sciences UMons
- Joined Necko Technologies in 2022

- AWS Cloud Developer
- IoT Specialist



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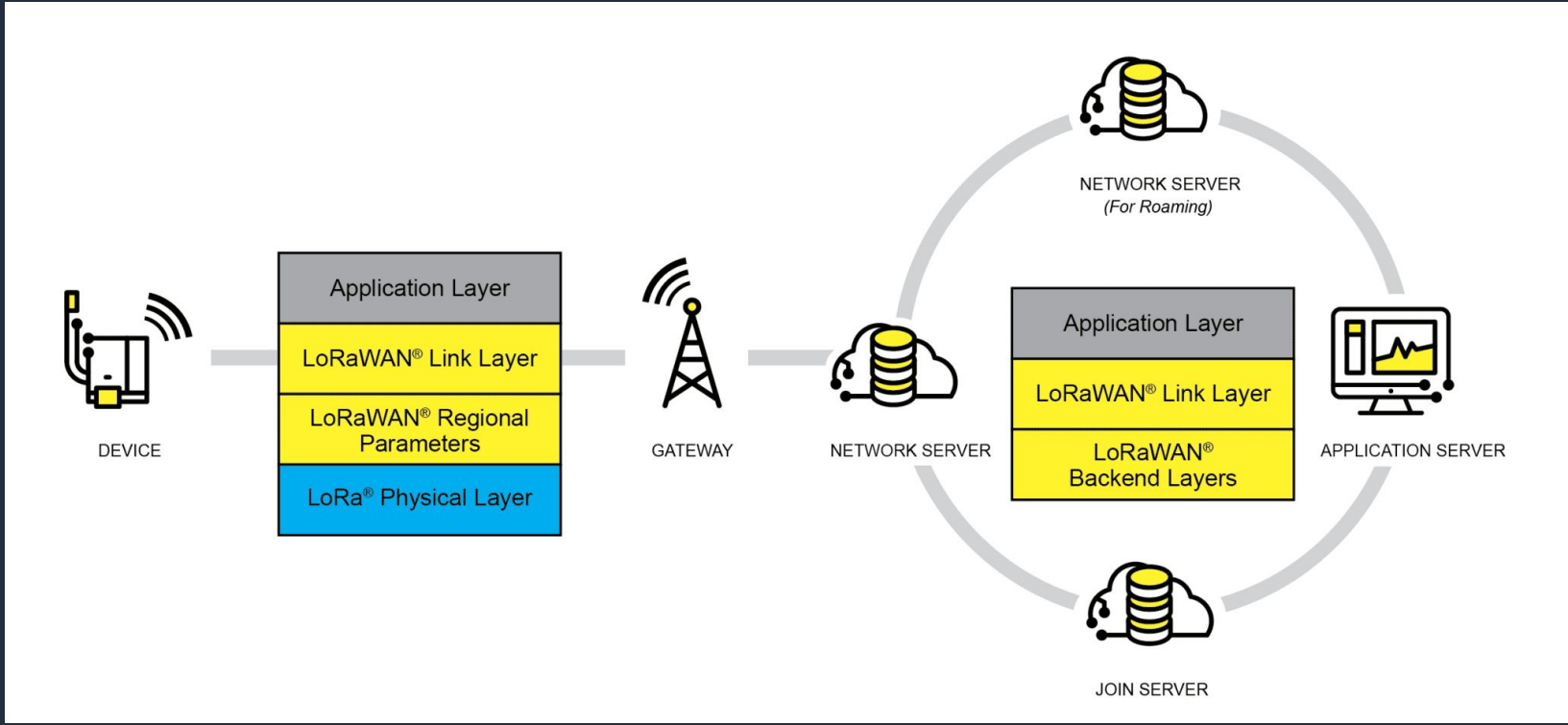
LoRaWAN



https://lora-alliance.org/about-lorawan/

Lora : long range

- 200m indoor
- 10 km outdoor
- record:
  - 1300 km with standard equipments
  - 800 000 km with specialized equipment

Lora

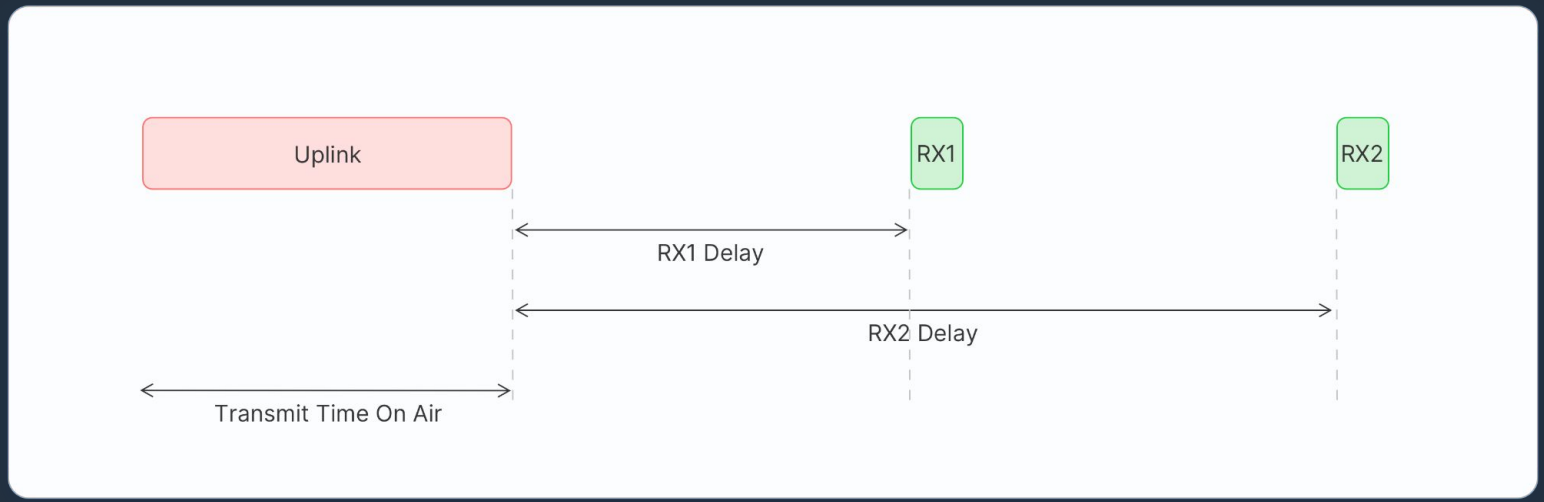
- since 2014
- created by Cycleo acquired by Semtech
- 300 million end devices in 2023

Lora

- Adaptive baud rate (spread factor)
- Low baud rate (3 to 50 kbps/s)
- Sub-GHz (ISM radio band, free to use)
- Frequence dependant to region
  868MHz EU, 900MHz US
- Downstream 10 times lower than upstream

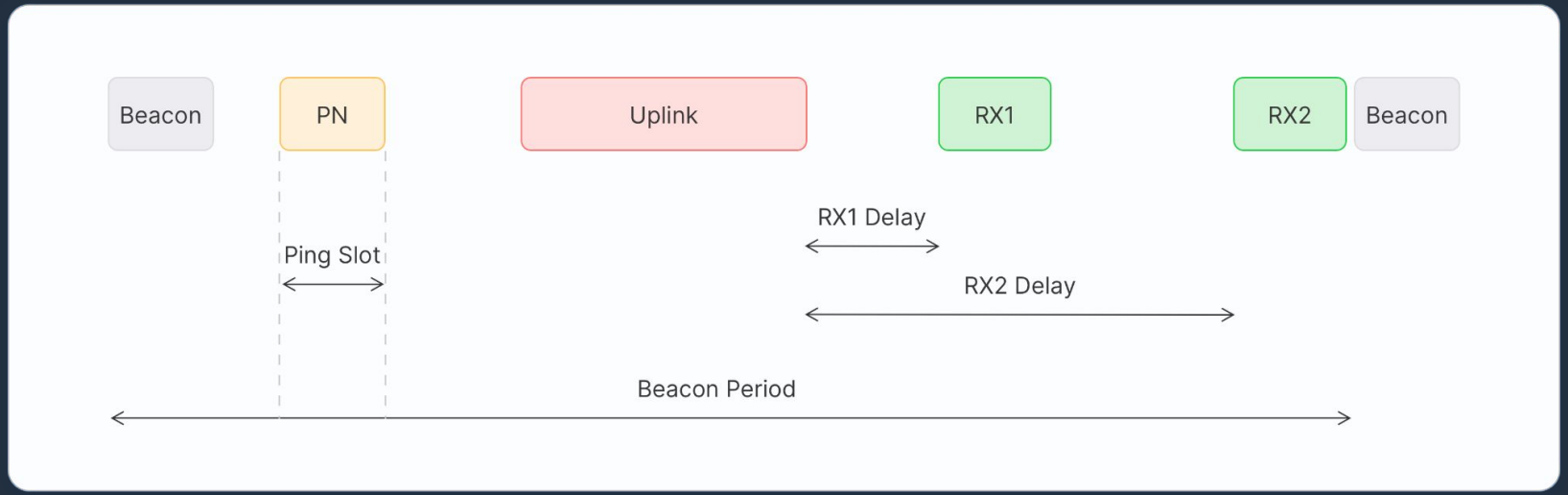
LoRaWAN: Device classes

Class A: battery powered (2 to 15 years)



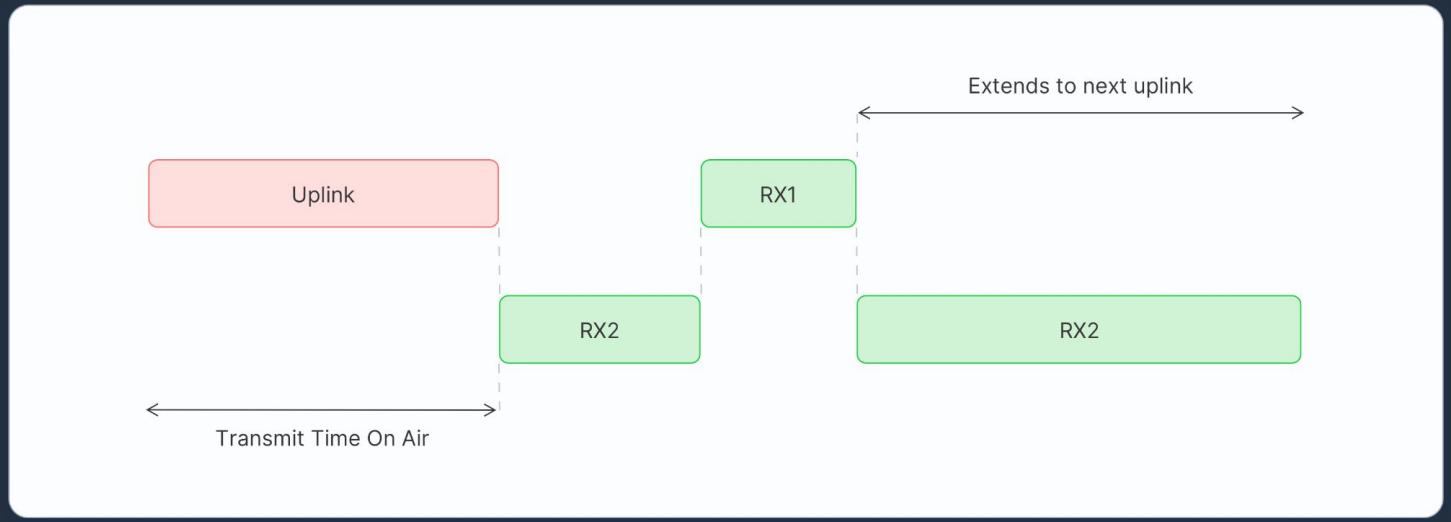
LoRaWAN: Device classes

Class B: Class A + period beacon



LoRaWAN: Device classes

Class C: Alway listening (connected to the grid)



LoRaWAN device

- Unique ID (EUID)
- Different authentications (based on keys)
- Session

Network types

- Public network:
  - Proximus (be)
  - Everynet (US, UK, IT,…)
  - Low orbit satellite constellation

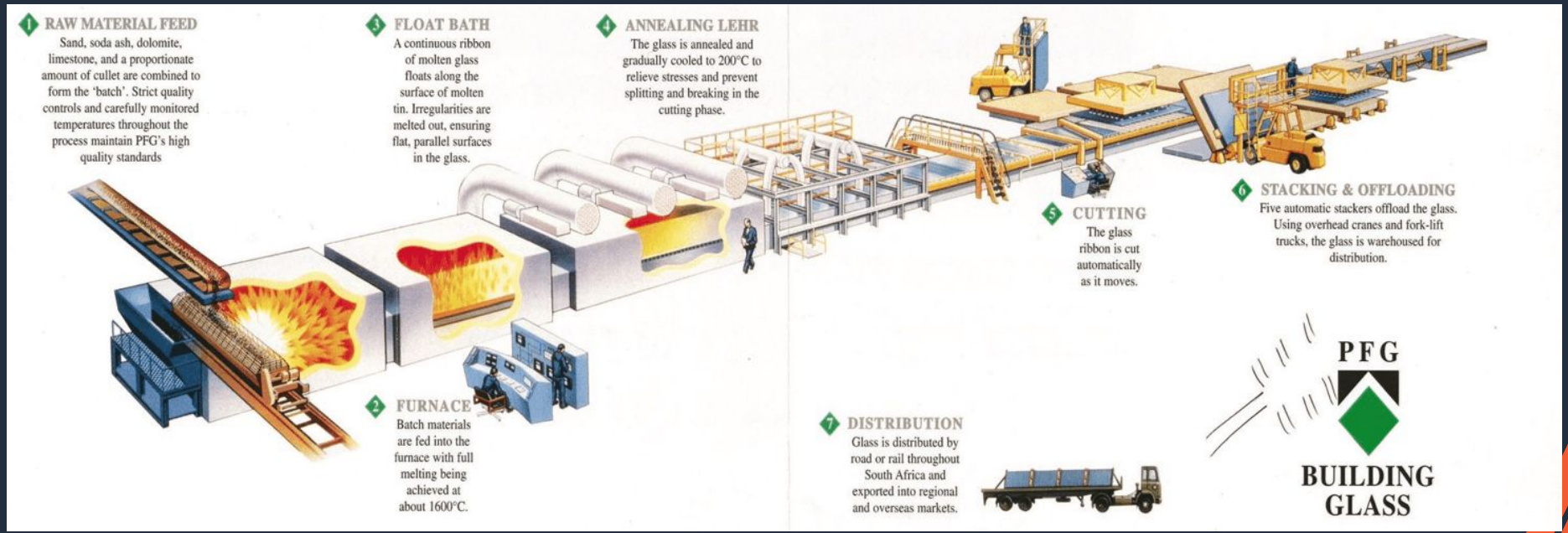
- Private network:
  - Gateways

Use case

Glass storage
Energy Management System

Glass manufacturing

500 meters long



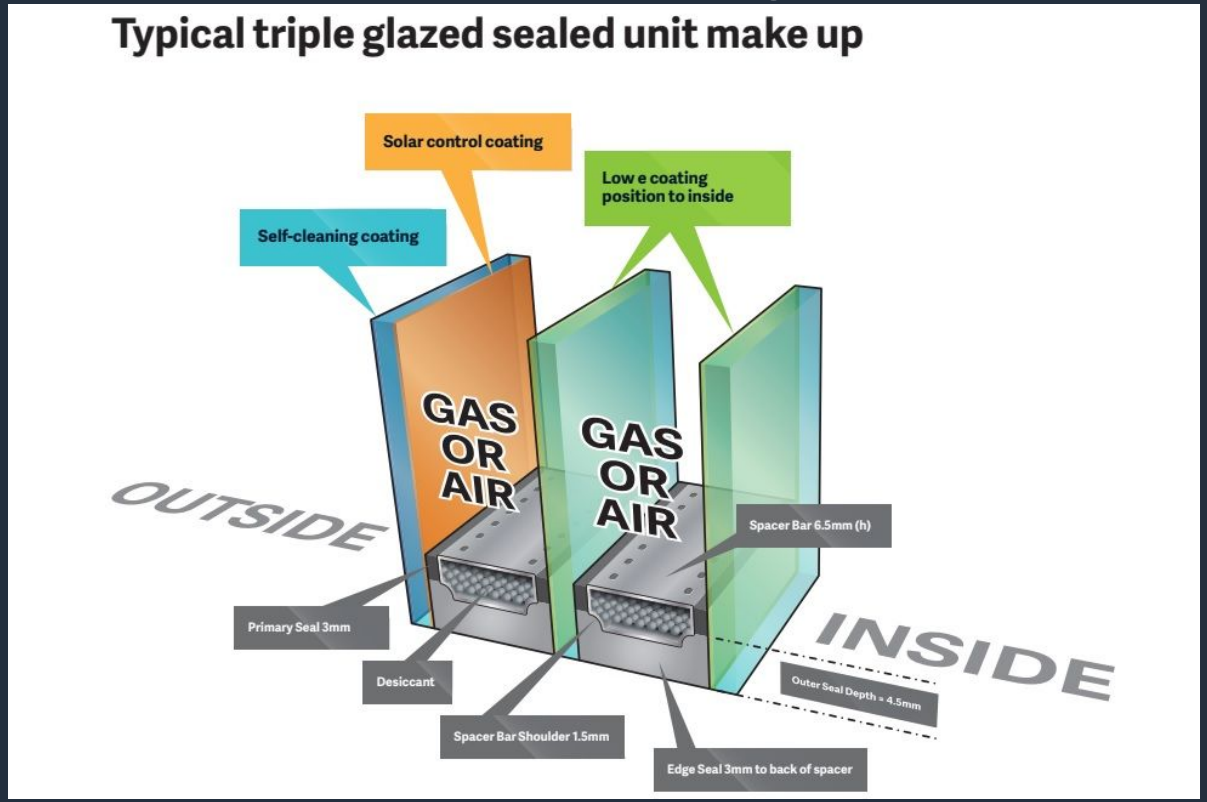
https://pfg.co.za/manufacturing-process/

Complementary video: https://www.youtube.com/watch?v=1HDWJgFLCfA

Glass manufacturing

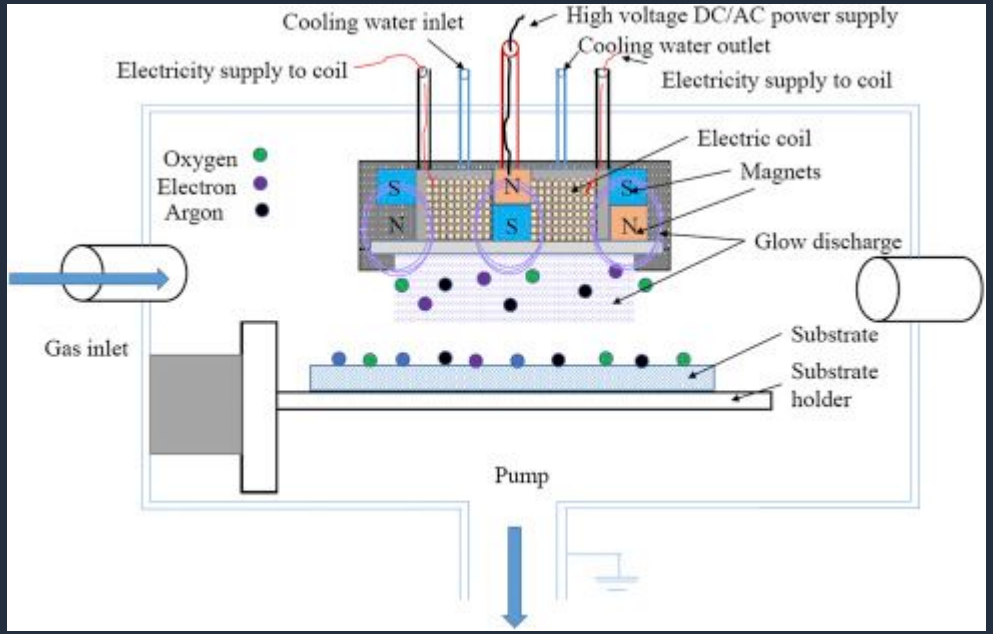
https://www.youtube.com/watch?v=SeRwrlGWYVc

Glass manufacturing



https://www.regencyglass.co.uk/solar-control-glazing-2/

Glass manufacturing



https://www.sciencedirect.com/topics/materials-science/magnetron-sputtering

Complementary video: https://www.youtube.com/watch?v=CB0nNTwPAoA

Use case

- Energy Management System

- Temperature of warehouses
- Consumption of heating system:
  - Electricity consumption
  - Gas consumption

- Goal: reduce heating then energy consumption

Humidity and temperature sensors

- ambient temperature
- relative humidity
- dew point
- frequency from 1 minutes to multiple days
- measurement aggregation

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Electricity measurement

- 1 record every 5 minutes
- Humidity and temperature
- Send index for each phase
- Send active, reactive energy
- Send active, reactive power
- Mean current, peak current
- Power factor

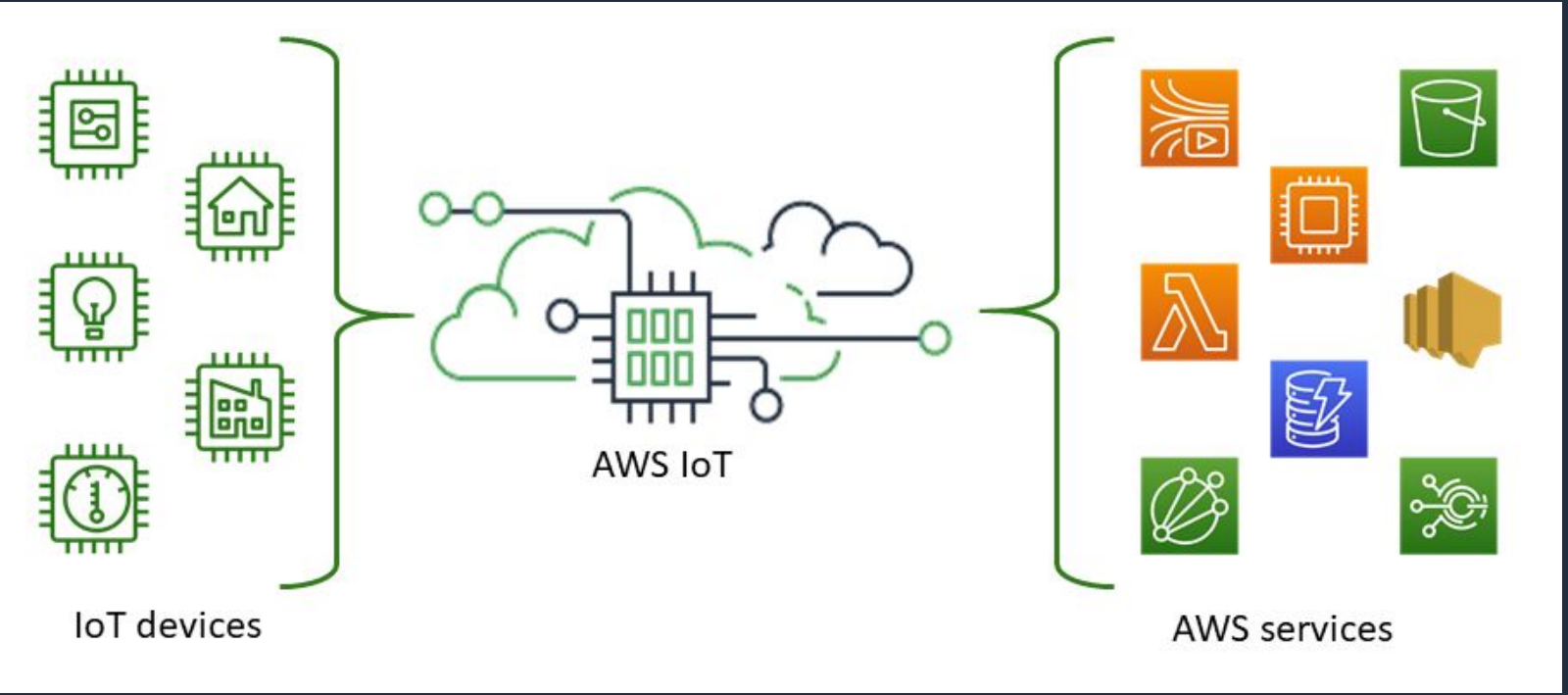
Measure and reduce reactive power

Pulse counter

- Gas and water meter can output pulses
- open/close contact
- send index

AWS Architecture

AWS architecture



AWS IoT Core

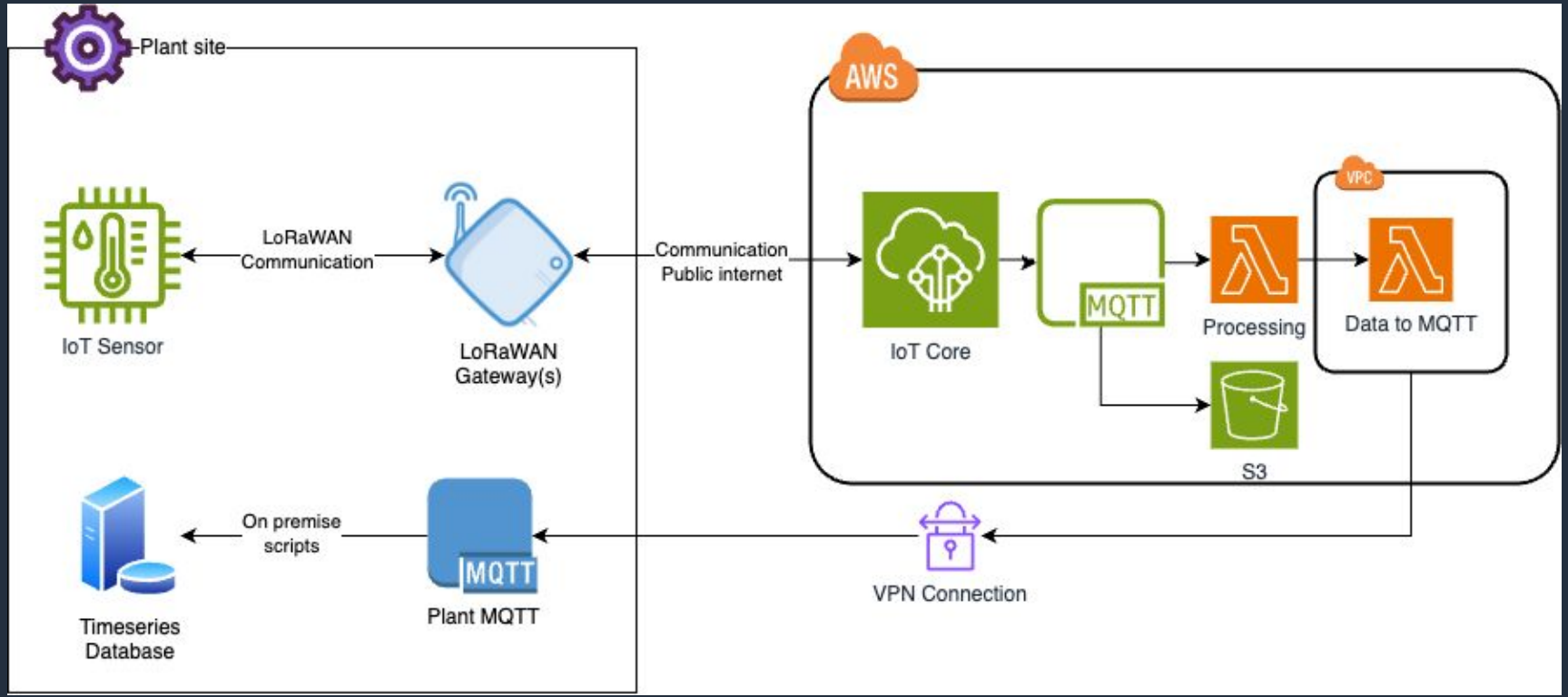
- Manage IoT sensors
- Manage certificates
- Manage sensor location
- Manage sensor firmware version

AWS IoT Core for LPWAN

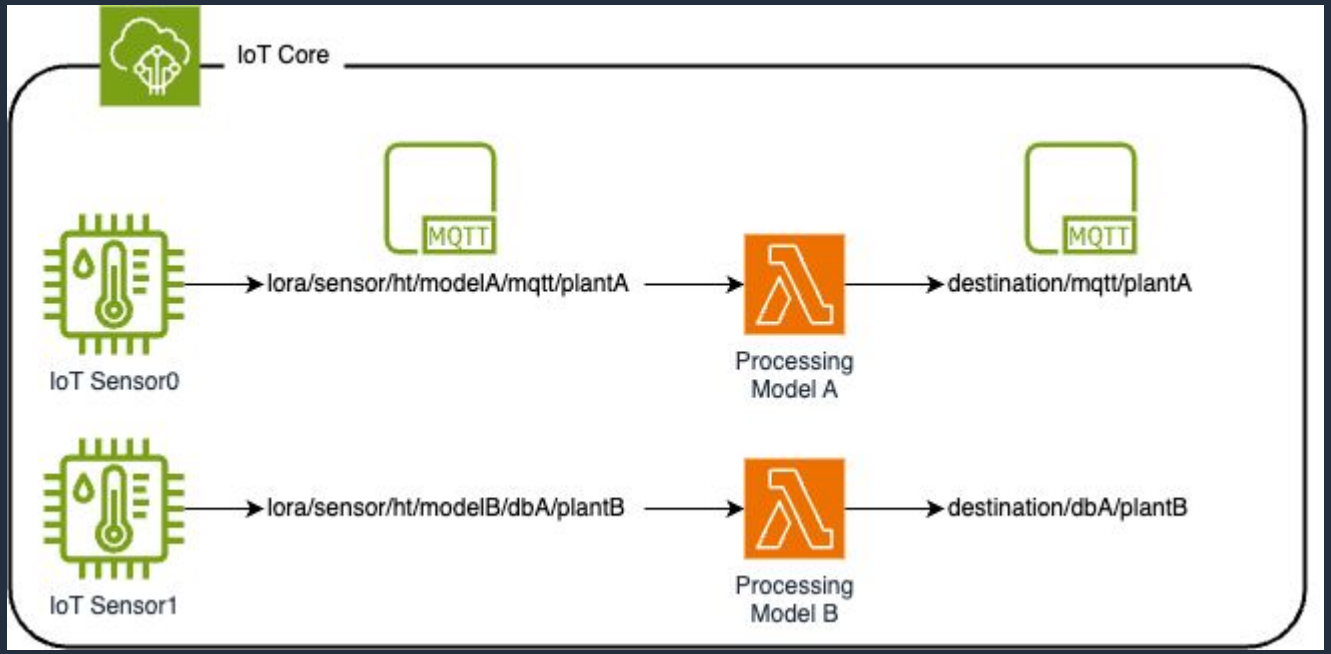
- Manage IoT sensors
- Manage certificates

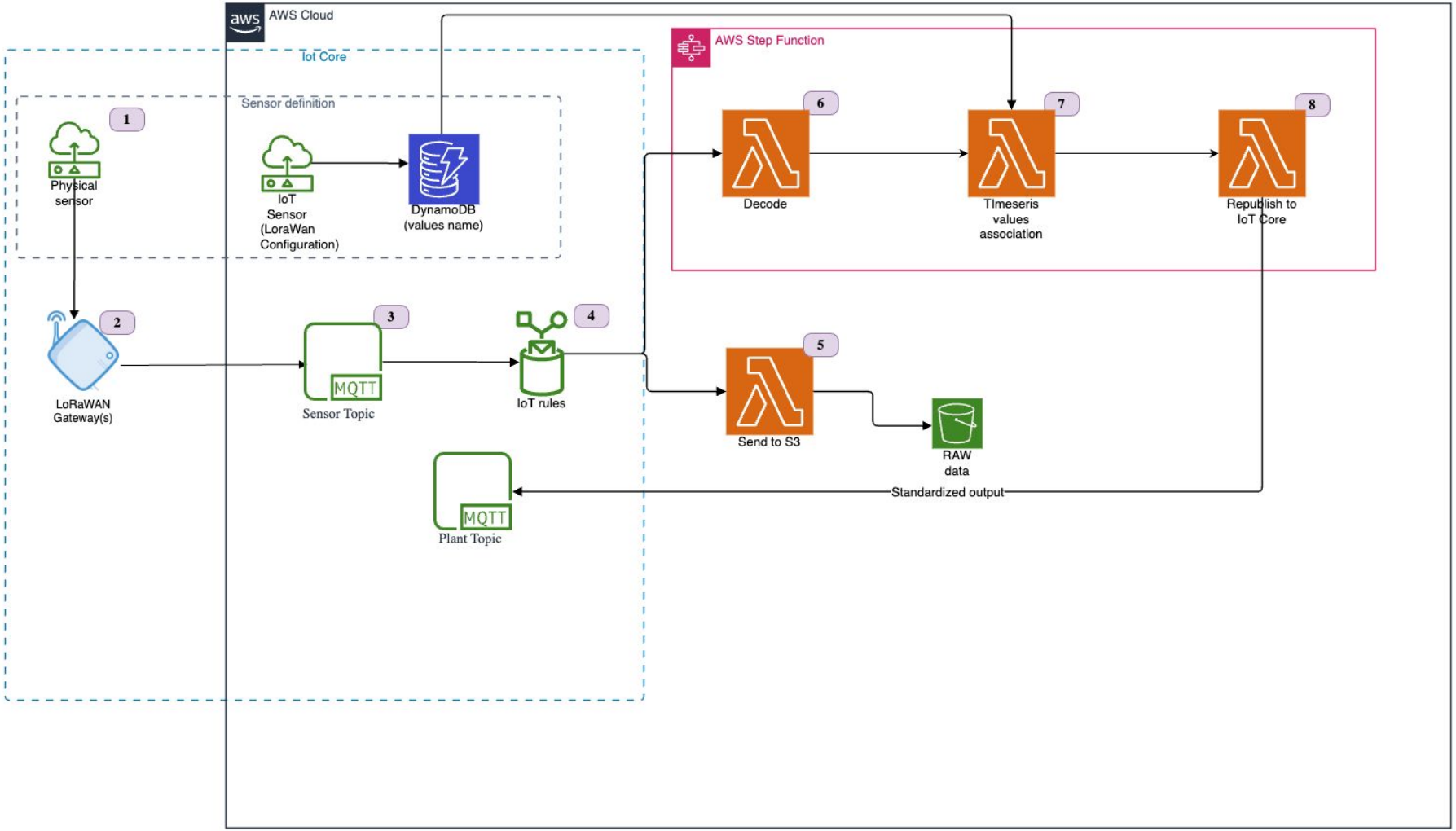
- Allow usage of LoRaWAN sensors
- Private and public network
- Handle rejoin between networks
- Allow uplink and downlink transmissions
- Event driven

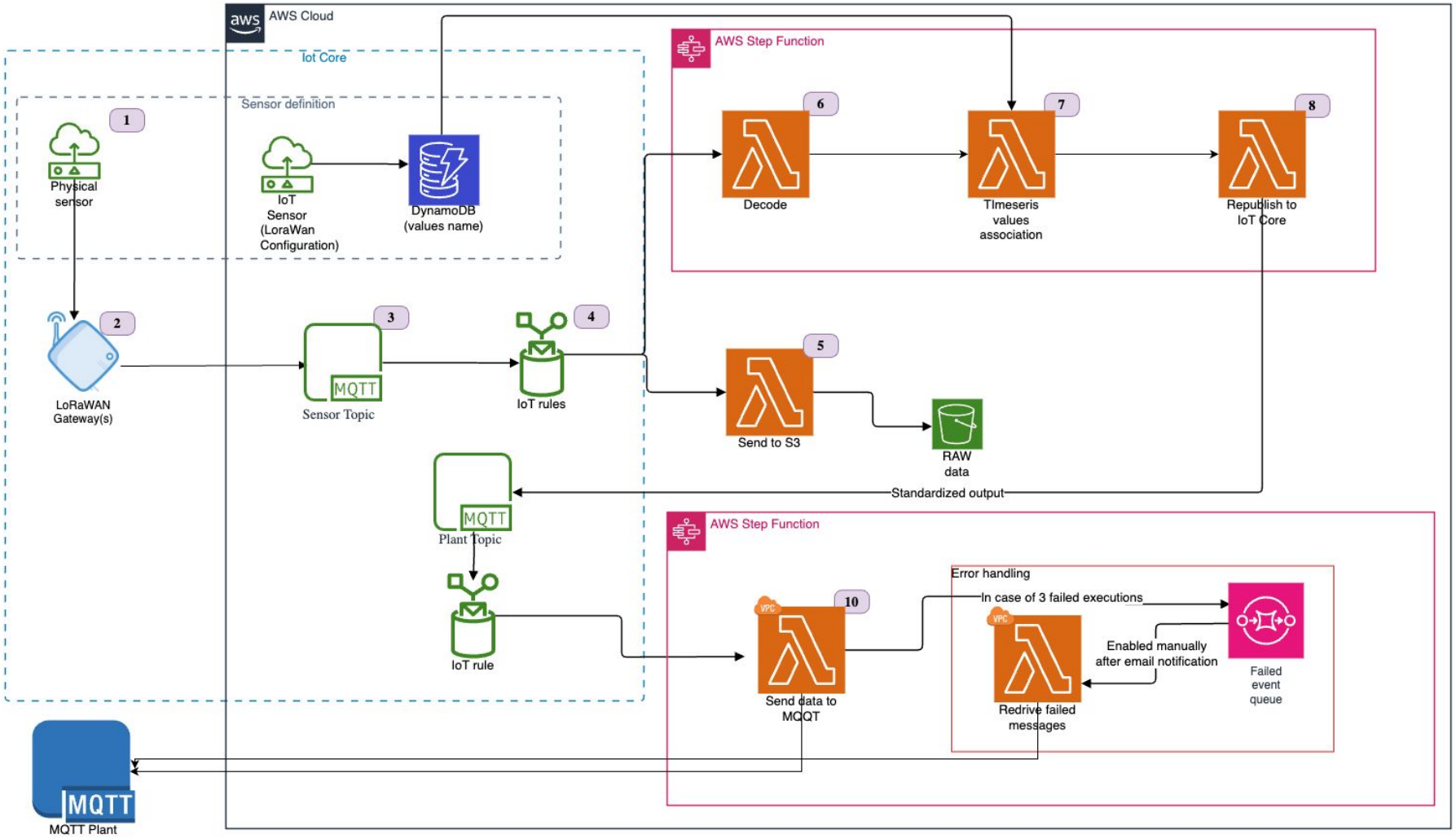
Event driven architecture



MQTT


IoT Core
MQTT
MQTT
lora/sensor/ht/modelA/mqtt/plantA
destination/mqtt/plantA
IoT Sensor0
Processing
Model A
lora/sensor/ht/modelB/dbA/plantB
destination/dbA/plantB
IoT Sensor1
Processing
Model B


AWS Cloud
Iot Core
Sensor definition
1
Physical sensor
IoT Sensor (LoraWan Configuration)
DynamoDB (values name)
AWS Step Function
6
Decode
7
TImeseris values association
8
Republish to IoT Core
2
LoRaWAN Gateway(s)
3
MQTT
Sensor Topic
4
IoT rules
5
Send to S3
RAW data
MQTT
Plant Topic
Standardized output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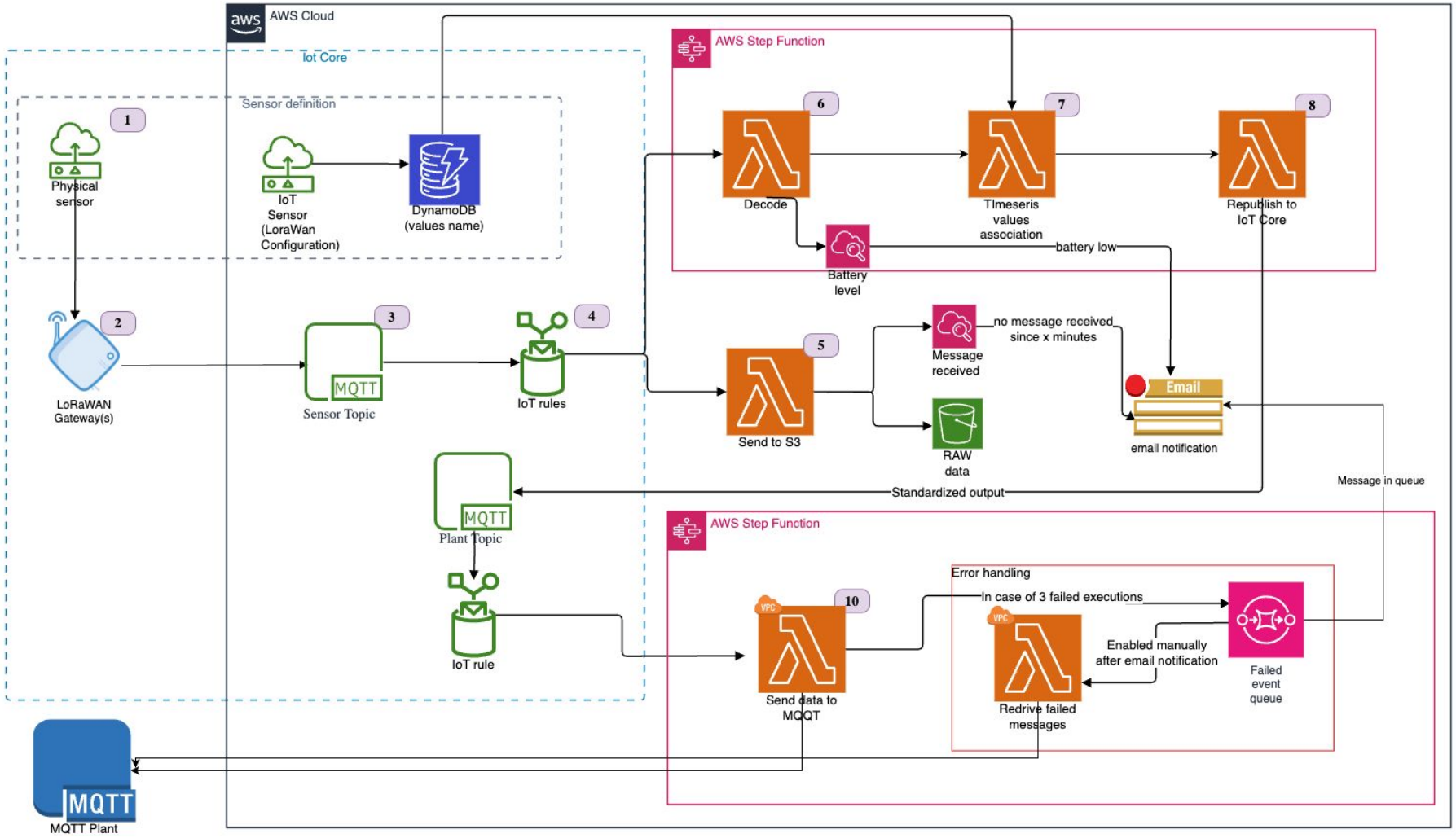
Republish to IoT Core
Standardized output
MQTT
Plant Topic
IoT rule
AWS Step Function
Error handling
10
Send data to MQQT
In case of 3 failed executions
Redrive failed messages
Enabled manually after email notification
Failed event queue
MQTT
MQTT Plant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8
Republish to IoT Core
Battery level
battery low
5
Send to S3
Message received
no message received since x minutes
RAW data
Email
email notification
Standardized output
Message in queue
MQTT
Plant Topic
IoT rule
AWS Step Function
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In case of 3 failed executions
Enabled manually after email notification
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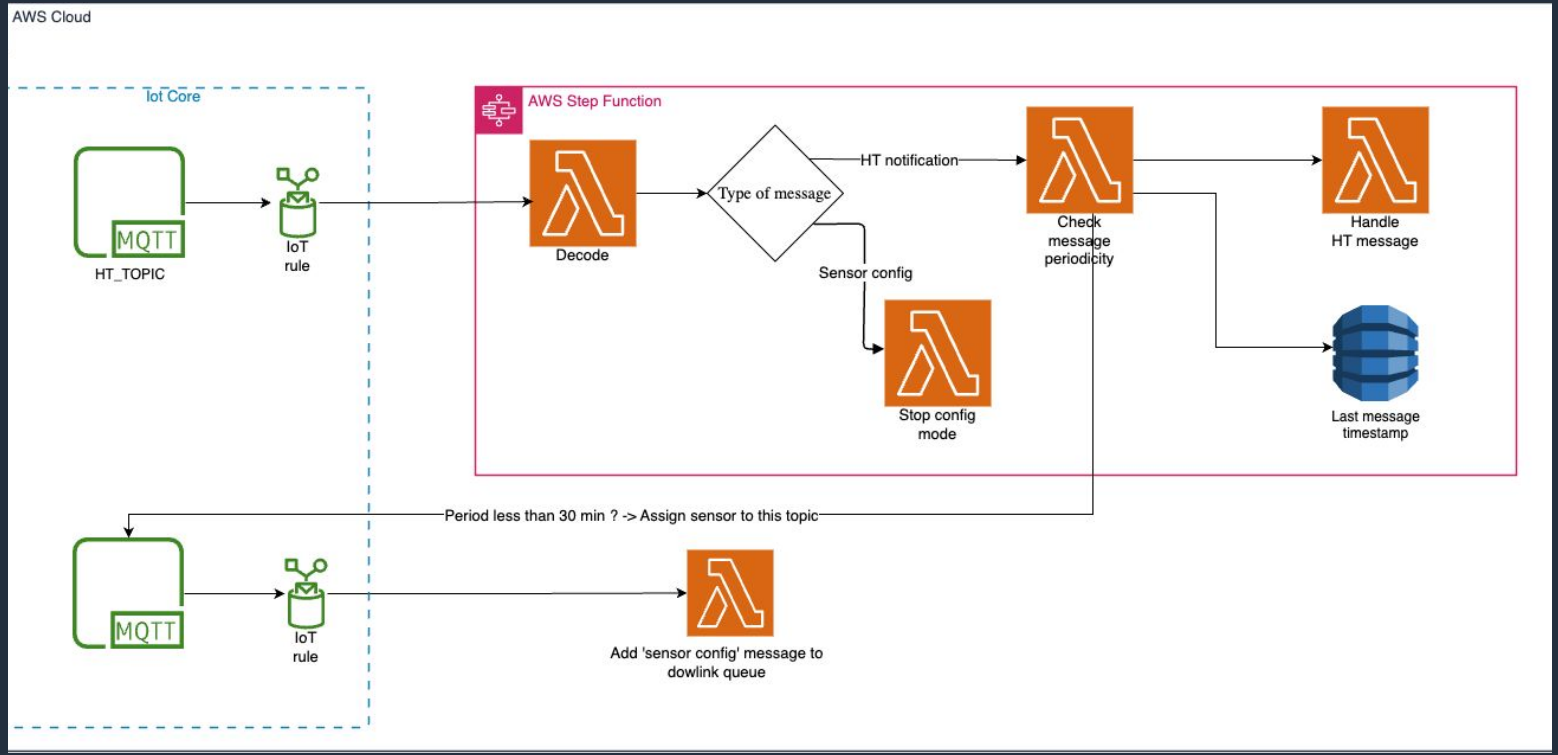
HT sensor automated configuration

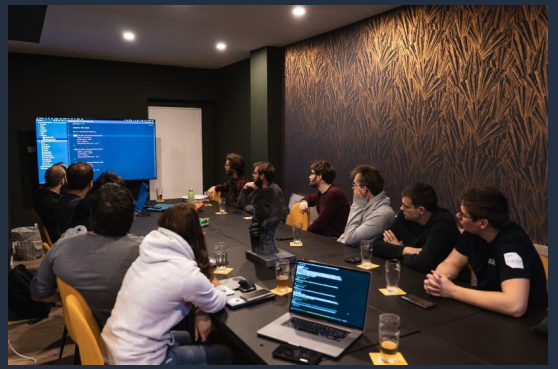


Result

- Reduce heating while avoiding condensation
- Good coverage in the plant
- Low percentage of message losses

Contact and conclusion

You want to join us ?
Come on!



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Contact us

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Thanks for your attention!

Please ask your questions now and feel free to contact us later

www.necko.tech

contact@necko.tech

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