IMT Atlantique
Bretagne-Pays de la Loire
École Mines-Télécom

EDF X-Renesas Synergy Student Challenge:

Smart Energy Management System for Electric Cars

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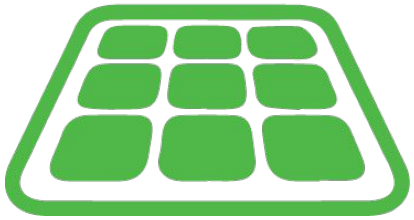
Blanca Martinez
Ange Ouya



Towards a Smart Energy Management System

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OUTLINE

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1. INTRODUCTION

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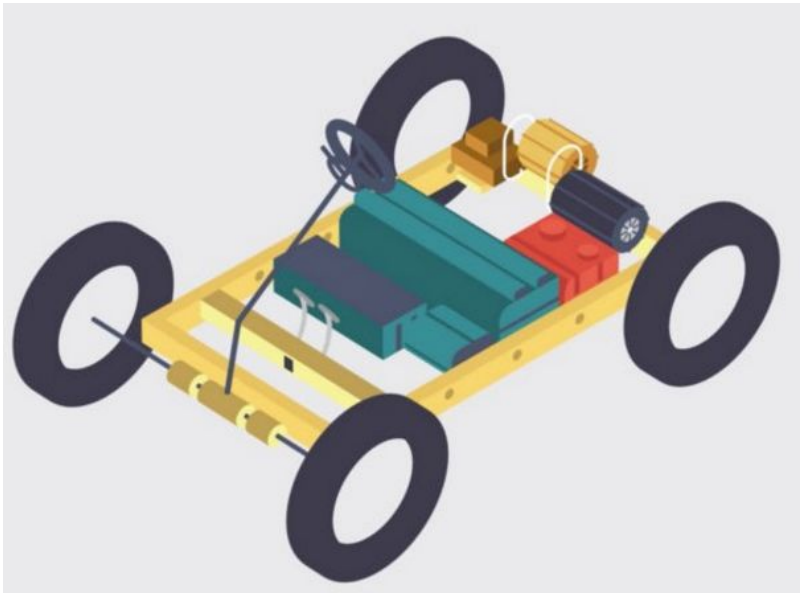
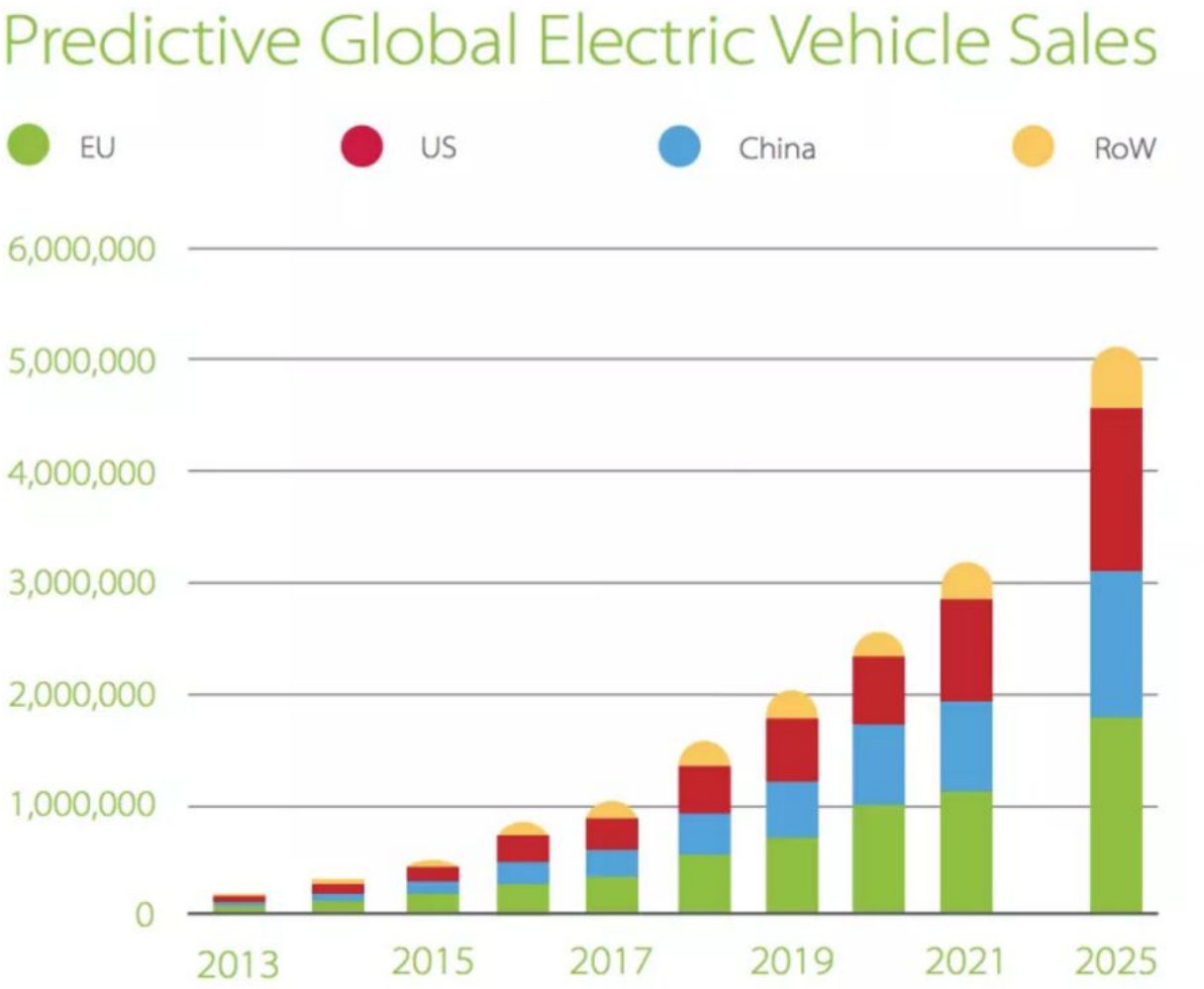
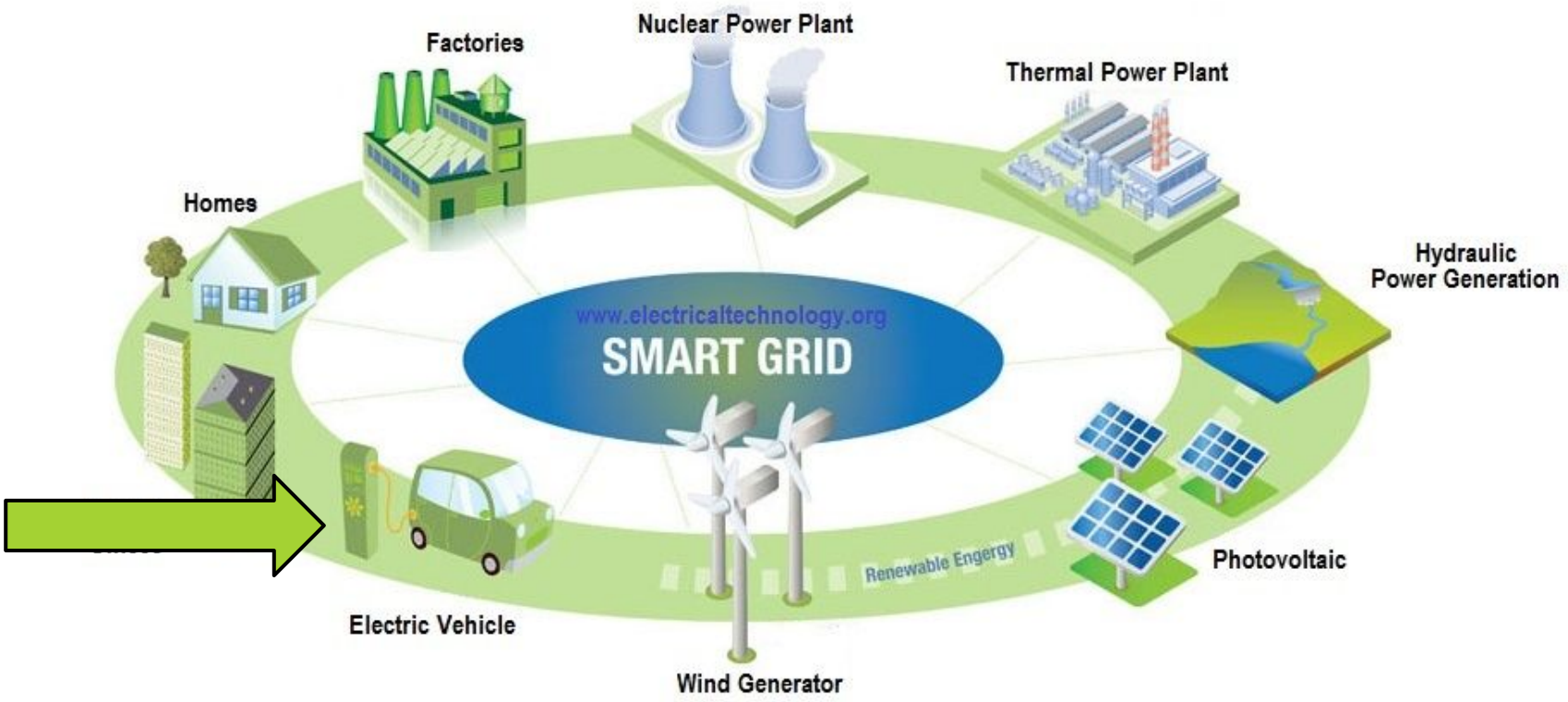
- IMT Atlantique Solar Panel Infrastructure
- Open Source Electric Car Research




Predictive Global Electric Vehicle Sales
EU
US
China
RoW
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
2013
2015
2017
2019
2021
2025

MOTIVATION

- Specifically designed to meet the increasing global demands
- Help measure and reduce energy consumption and costs
- Reduce carbon footprint



2. PROPOSED ARCHITECTURE

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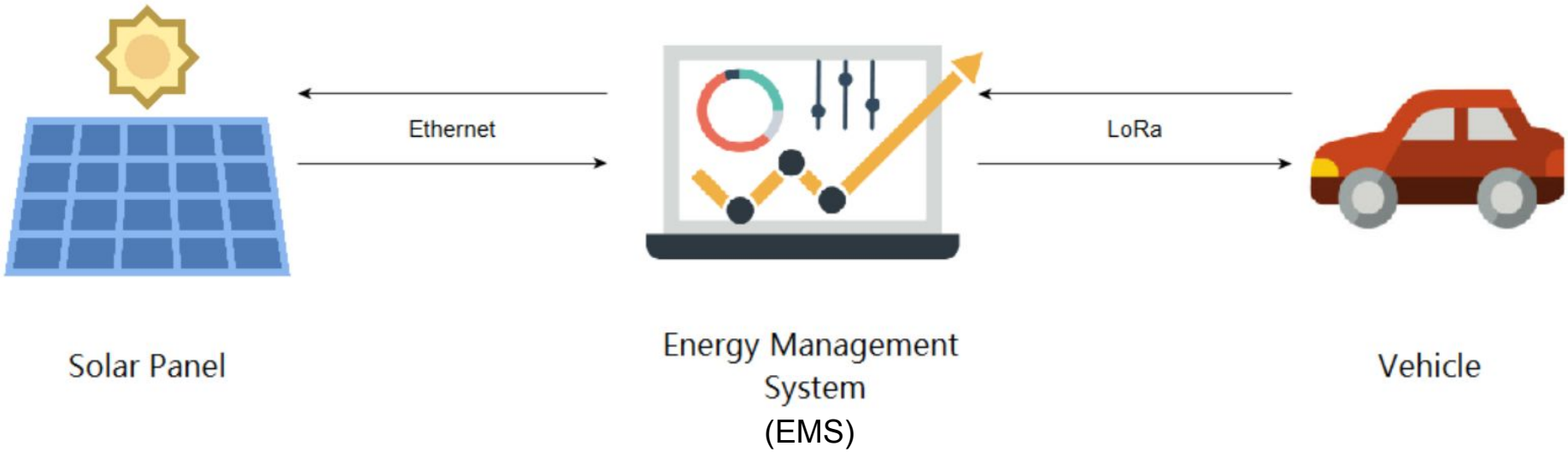
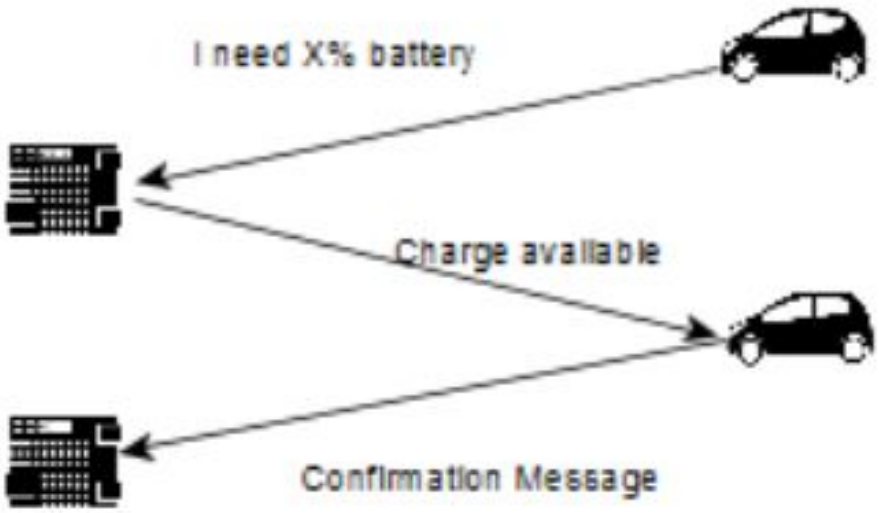
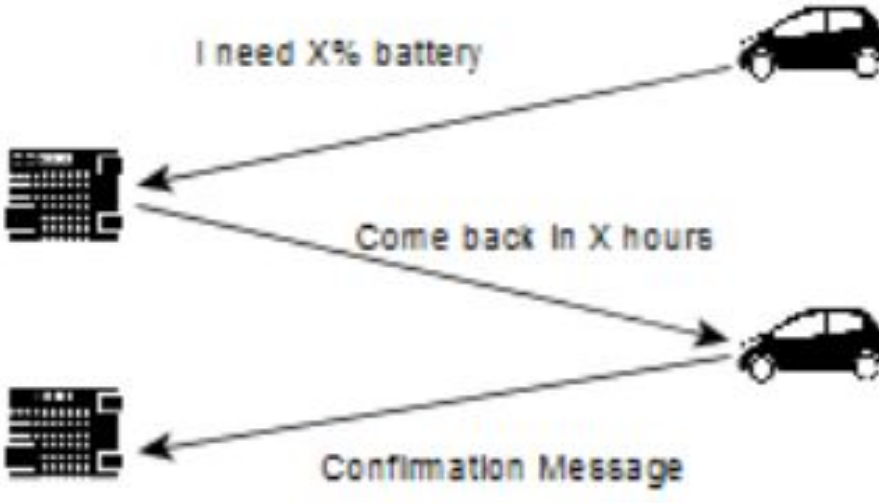
ARCHITECTURE



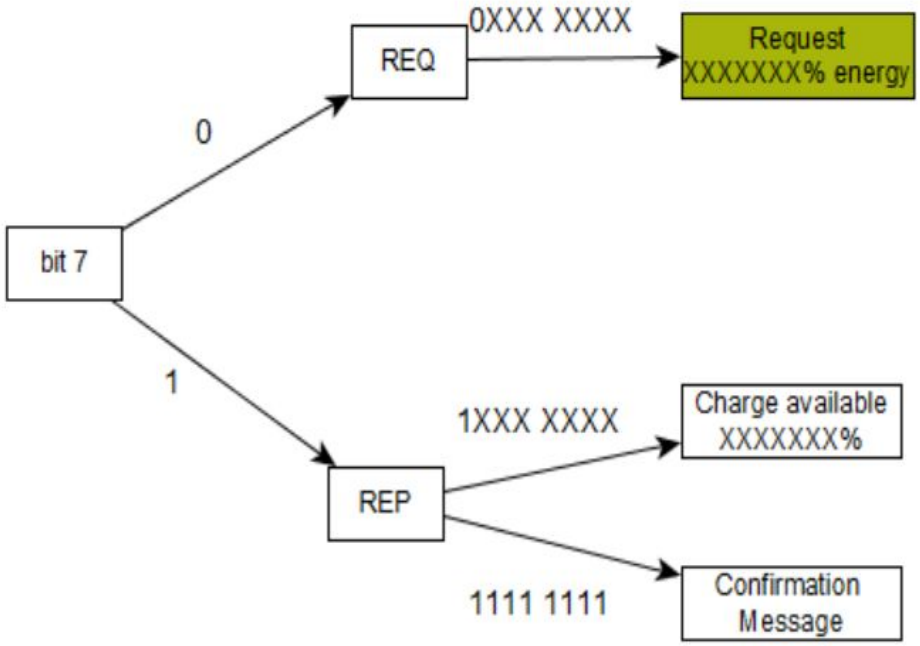
EMS CAN provide energy



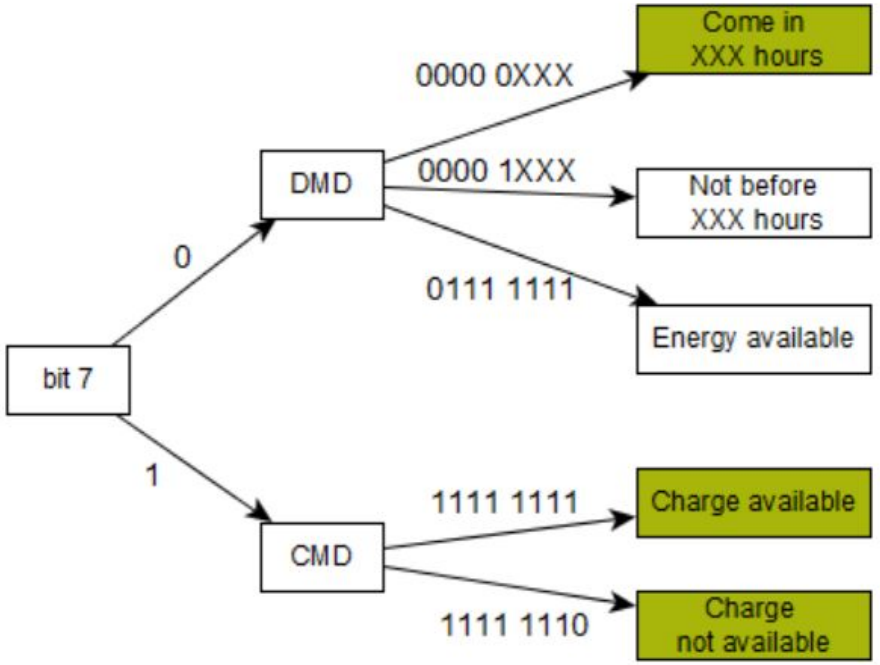
EMS CAN'T provide energy



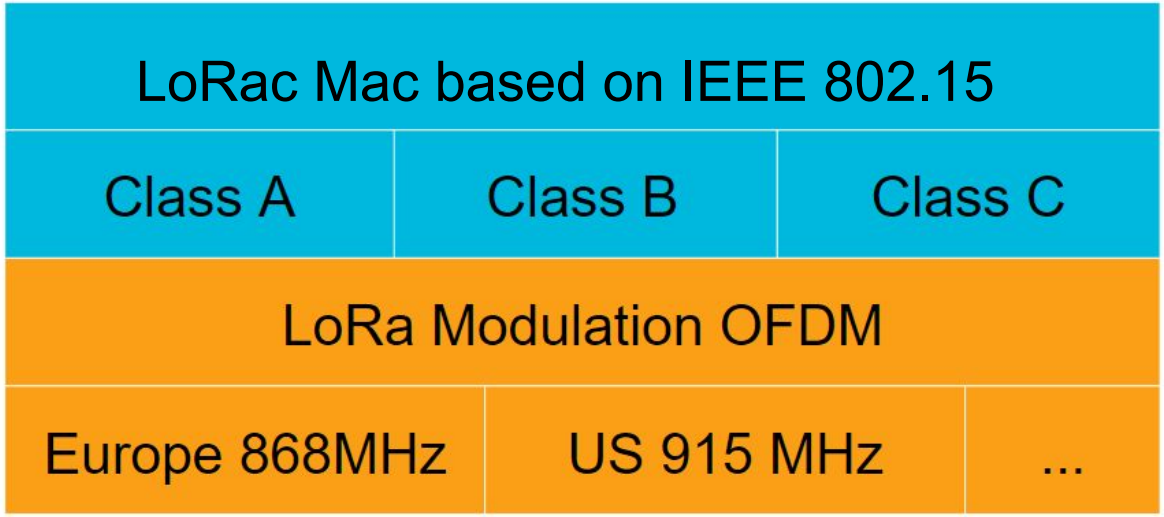
Car

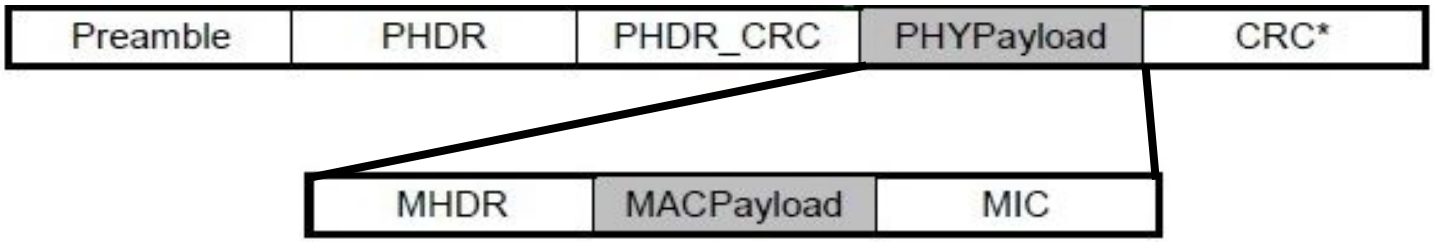


Energy Management System



LoRa Communication

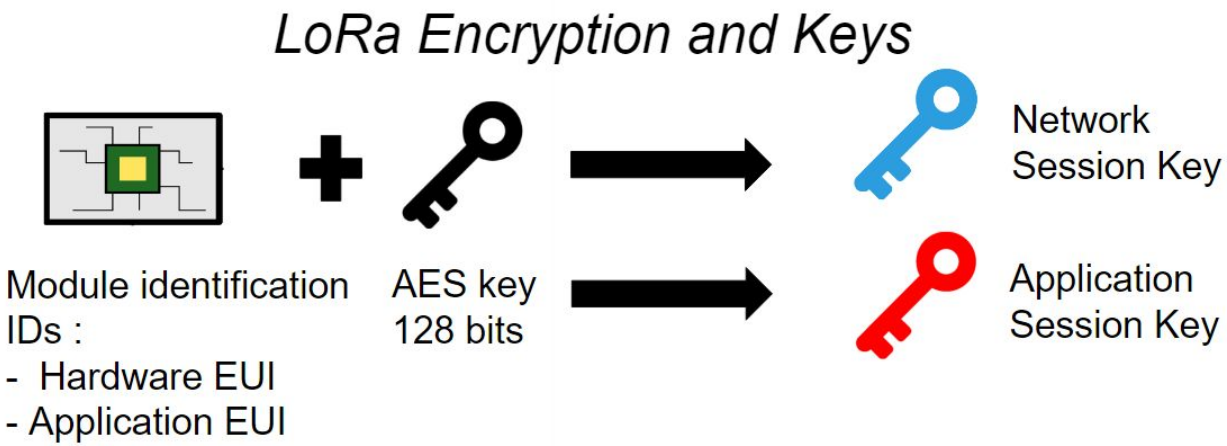




JOINING THE NETWORK FIRST

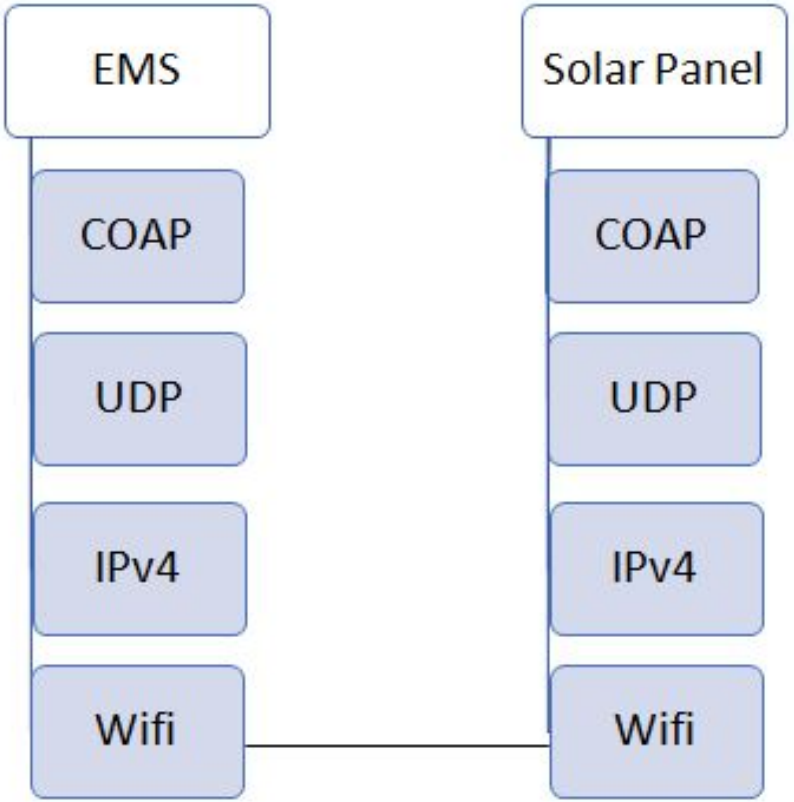
EMS and Car share the same AES key to encrypt the join procedure

- **Car sends a join request to the EMS : Car ID as payload**
- **EMS sends a join answer to the Car : EMS ID as payload**
- **Generation of Session Keys**



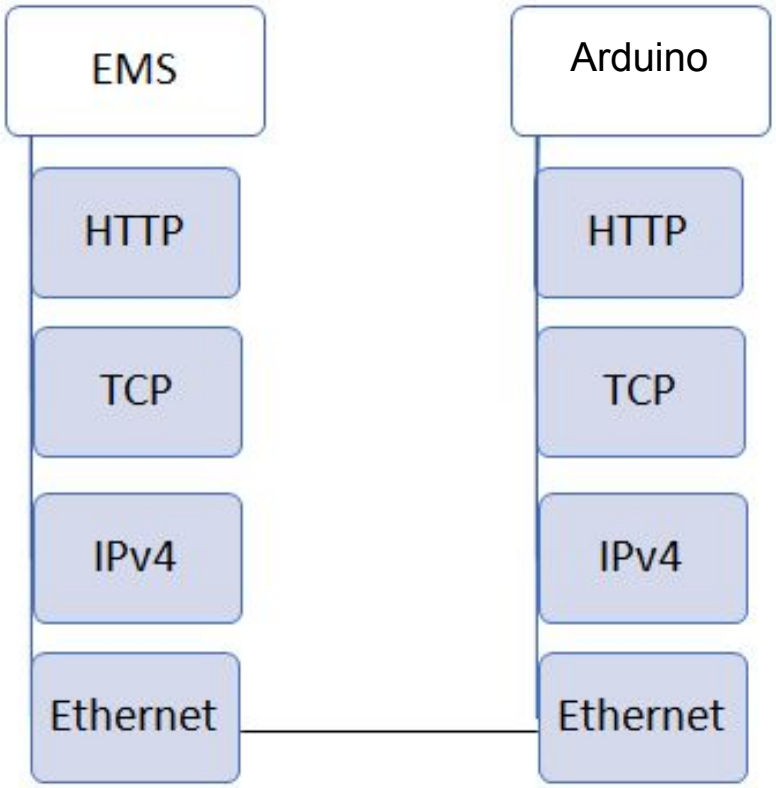
EMS & SOLAR PANEL COMMUNICATION

Rennes



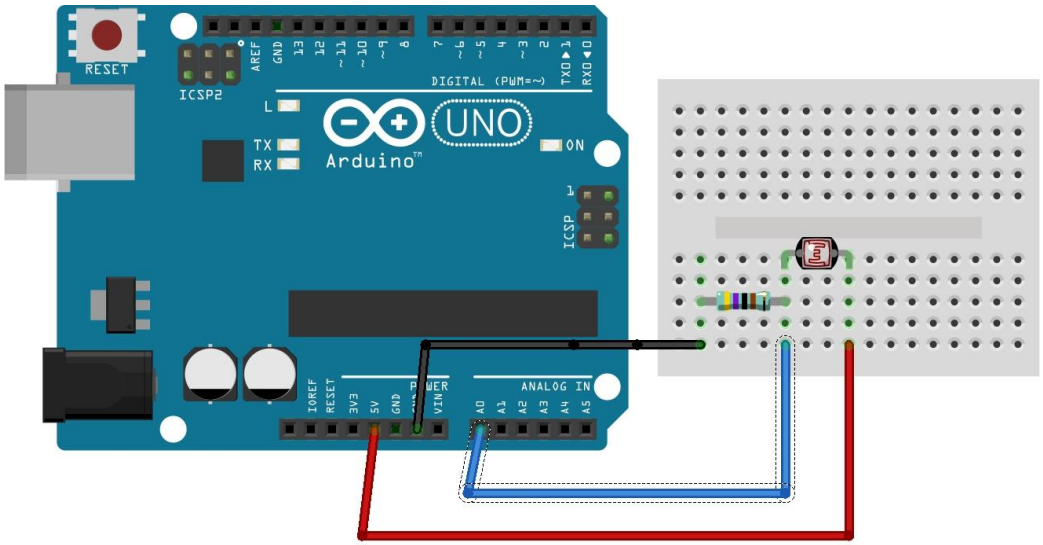
GET: coap://pvpanel/1/power

Paris (Demo)



GET http://www.informationsSolarPanel HTTP/1.0
Accept : text/html

Arduino as solar panel



Conversion of read value(A0) in watt

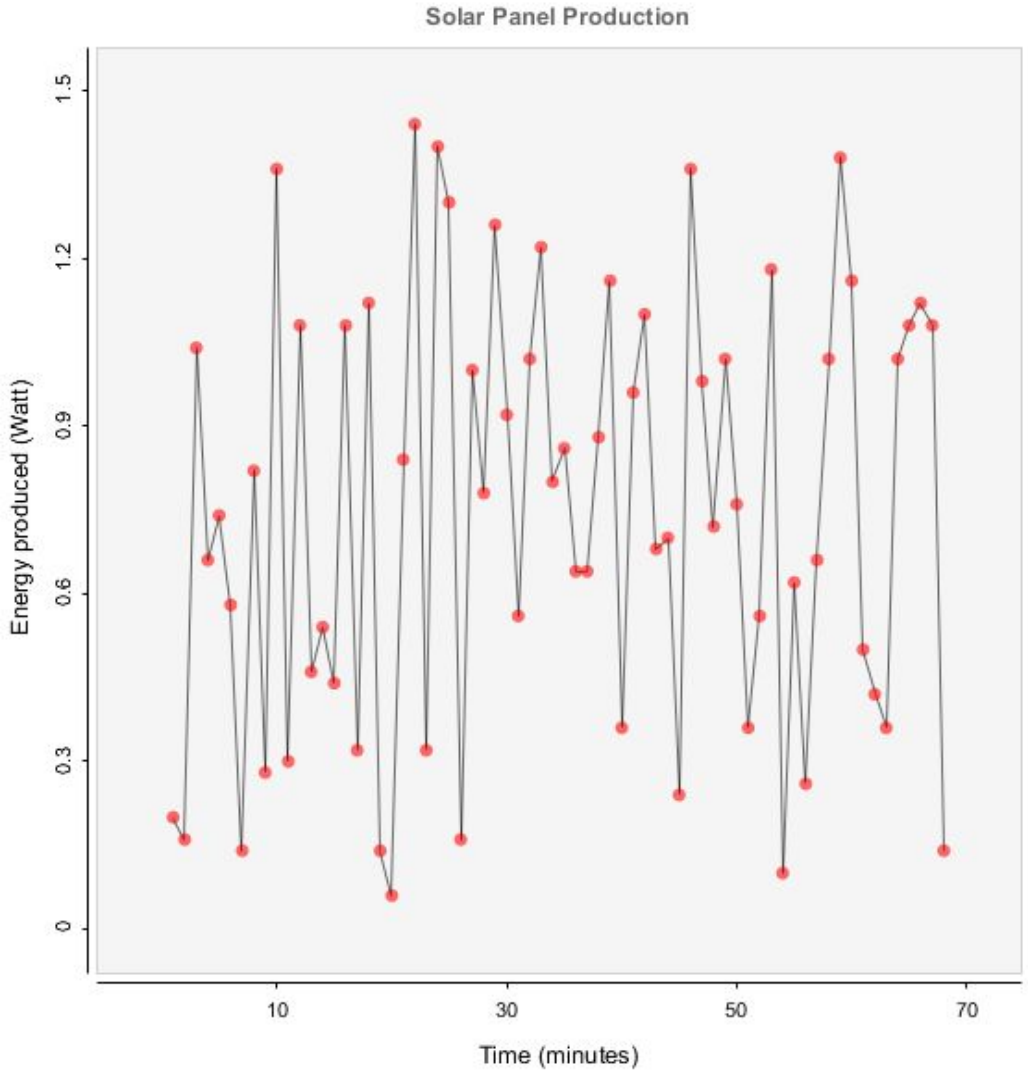
P(watt) = (Ev * Area) / Efficacy

- Area = 0.0015 m2

- Efficacy = 15 lm/W

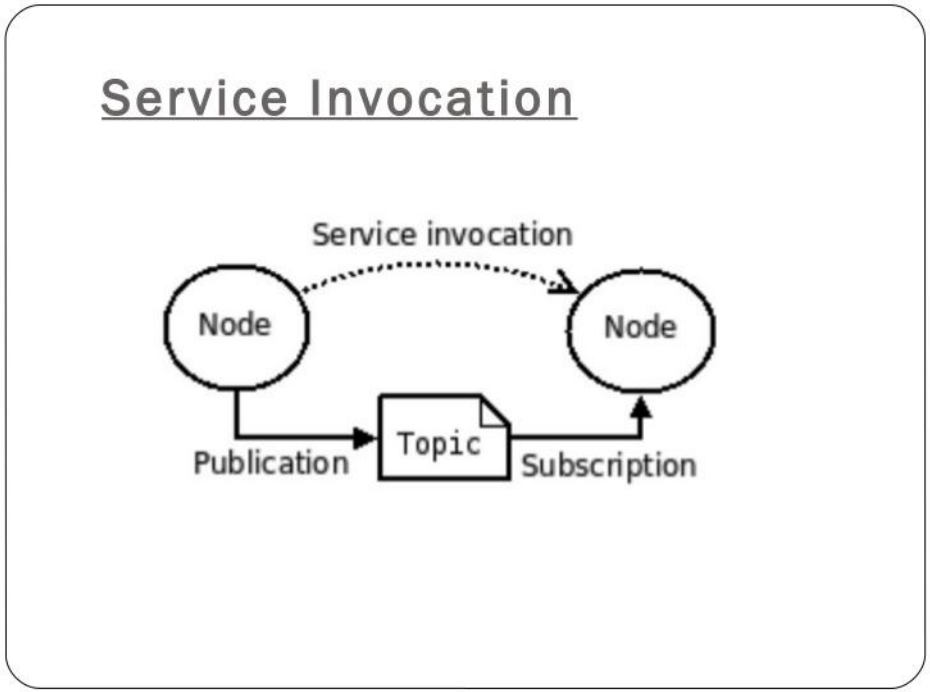
- Ev = ((500(1024-A0)) / 10A0) lm/m2

EMS & SOLAR PANEL COMMUNICATION

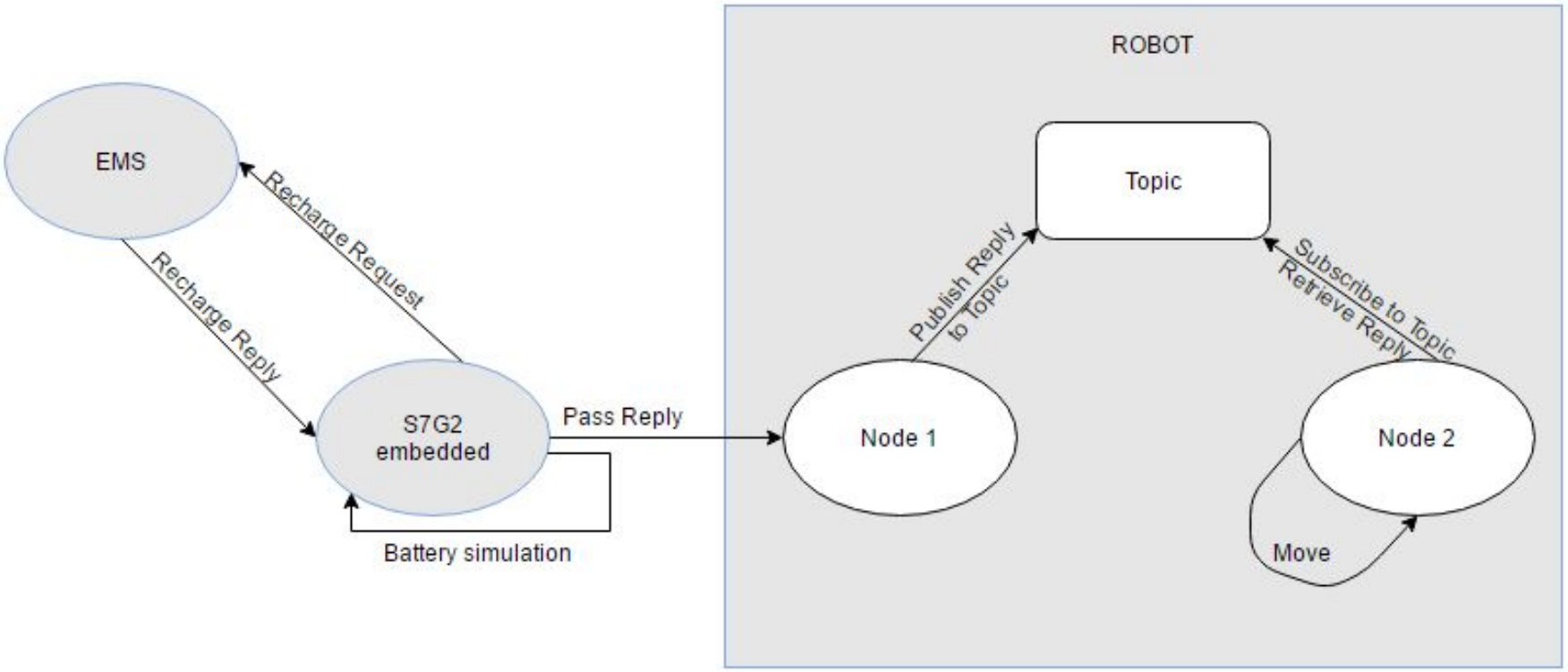


- Energy stored in the EMS
- Prediction of next production values

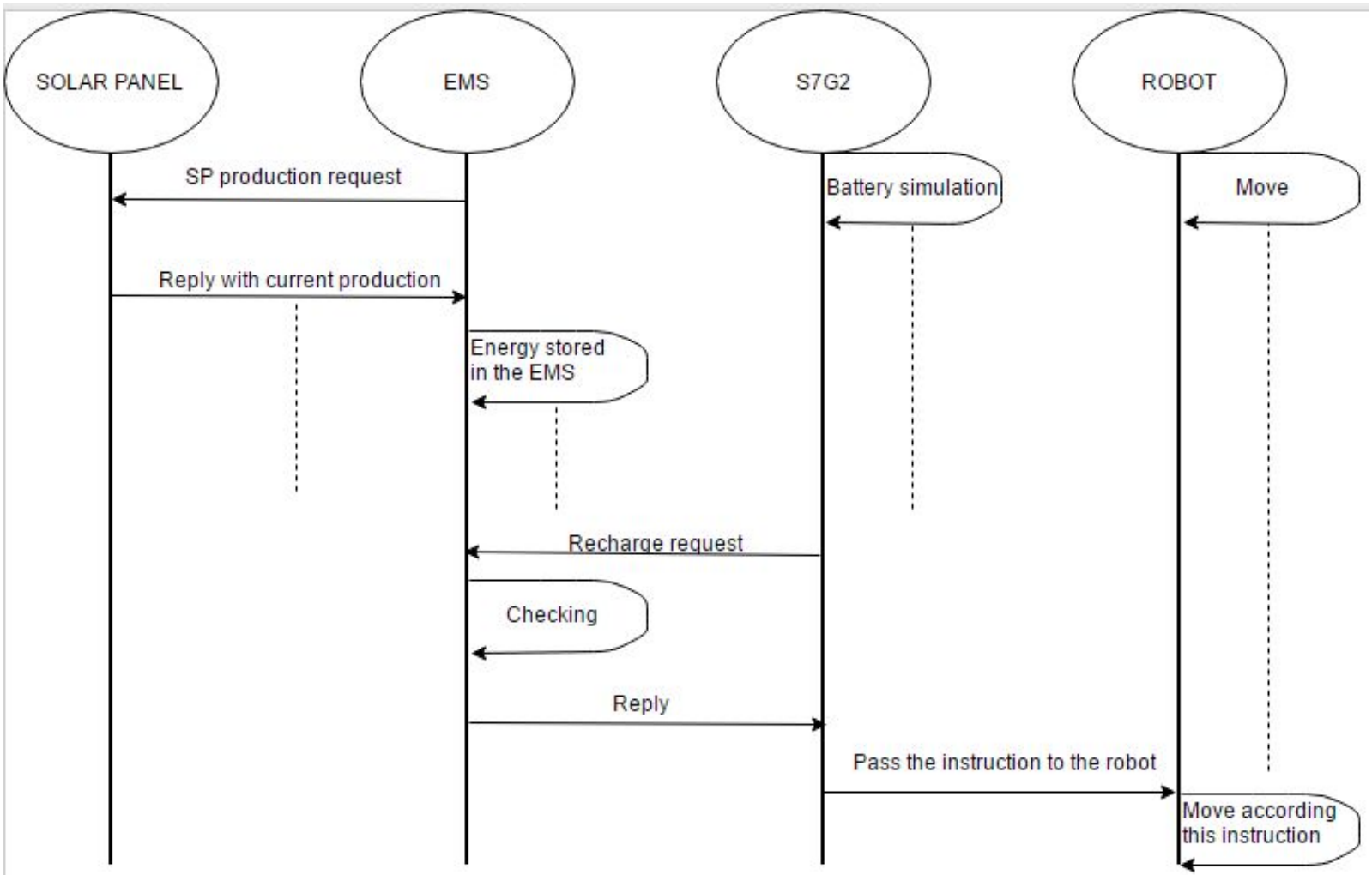
- ROS (Robot Operating System)
- Messaging System



OUR VEHICLE


ROBOT
EMS
Recharge Request
Recharge Reply
S7G2
embedded
Pass Reply
Battery simulation
Topic
Publish Reply
to Topic
Subscribe to Topic
Retrieve Reply
Node 1
Node 2
Move

GLOBAL ARCHITECTURE



3. FUTURE TASKS

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WHAT COULD BE DONE

- PLC Communication
- Vehicle to Grid implementation
- Identification for Business

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4. DEMO