FABRIC

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Exploring Particle Swarm Optimization for Dynamic Charging EVs Navigation

Oussama Smiai, Francesco Bellotti, Riccardo Berta, Alessandro De Gloria

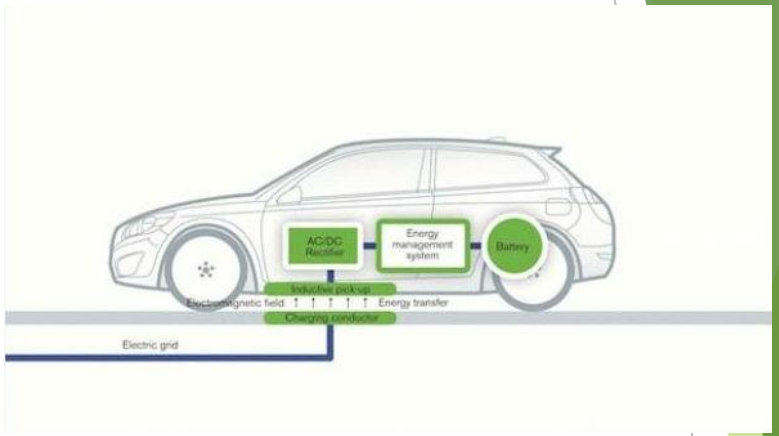
Contact:oussama.smiai@elios.unige:it

Outline of the presentation

- Fabric project
- Test sites
- Navigation for dynamic charging
- Towards hw implementation
- Conclusions

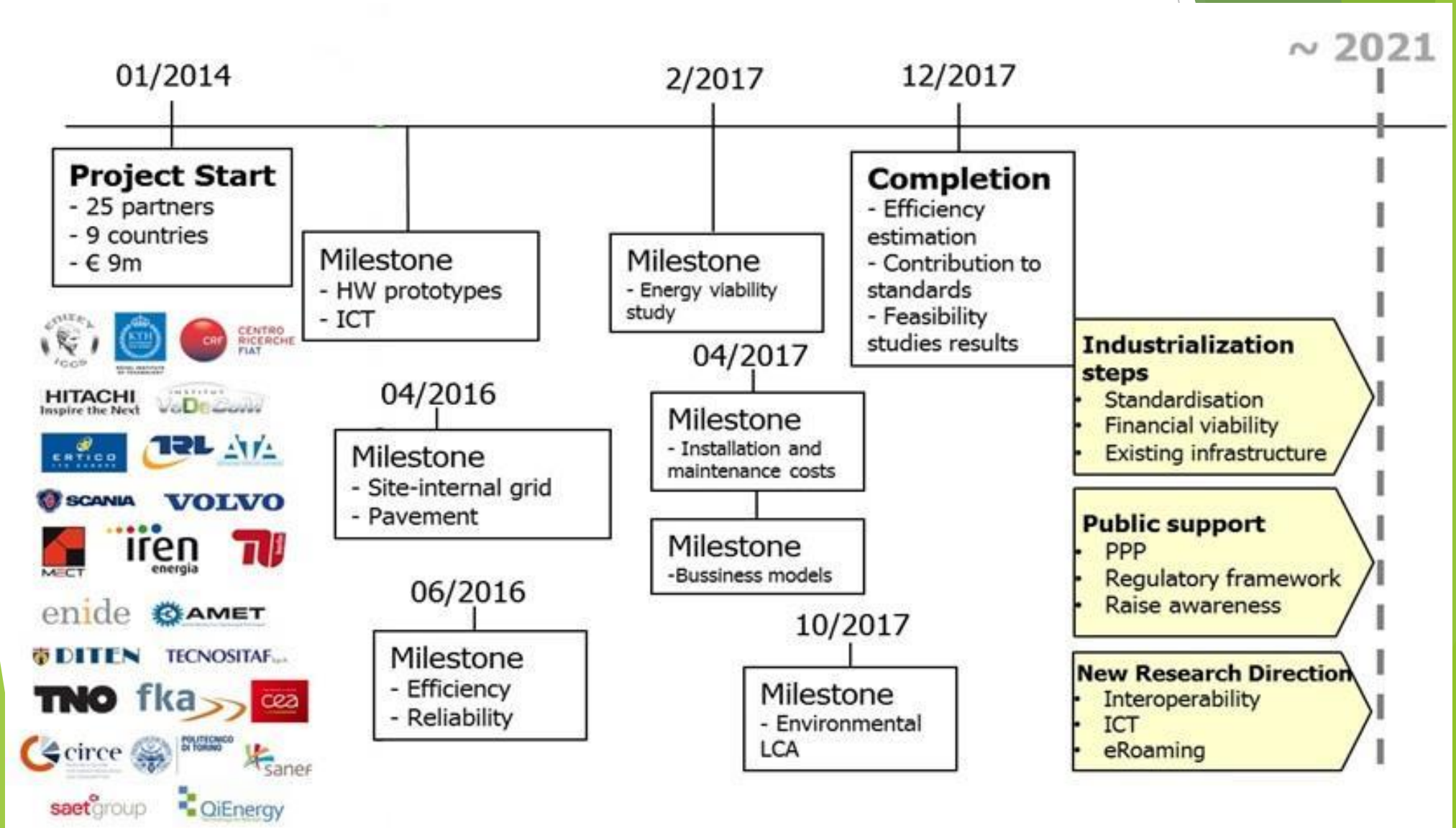
Dynamic Charging of Electric Vehicle

Static charging



Dynamic charging

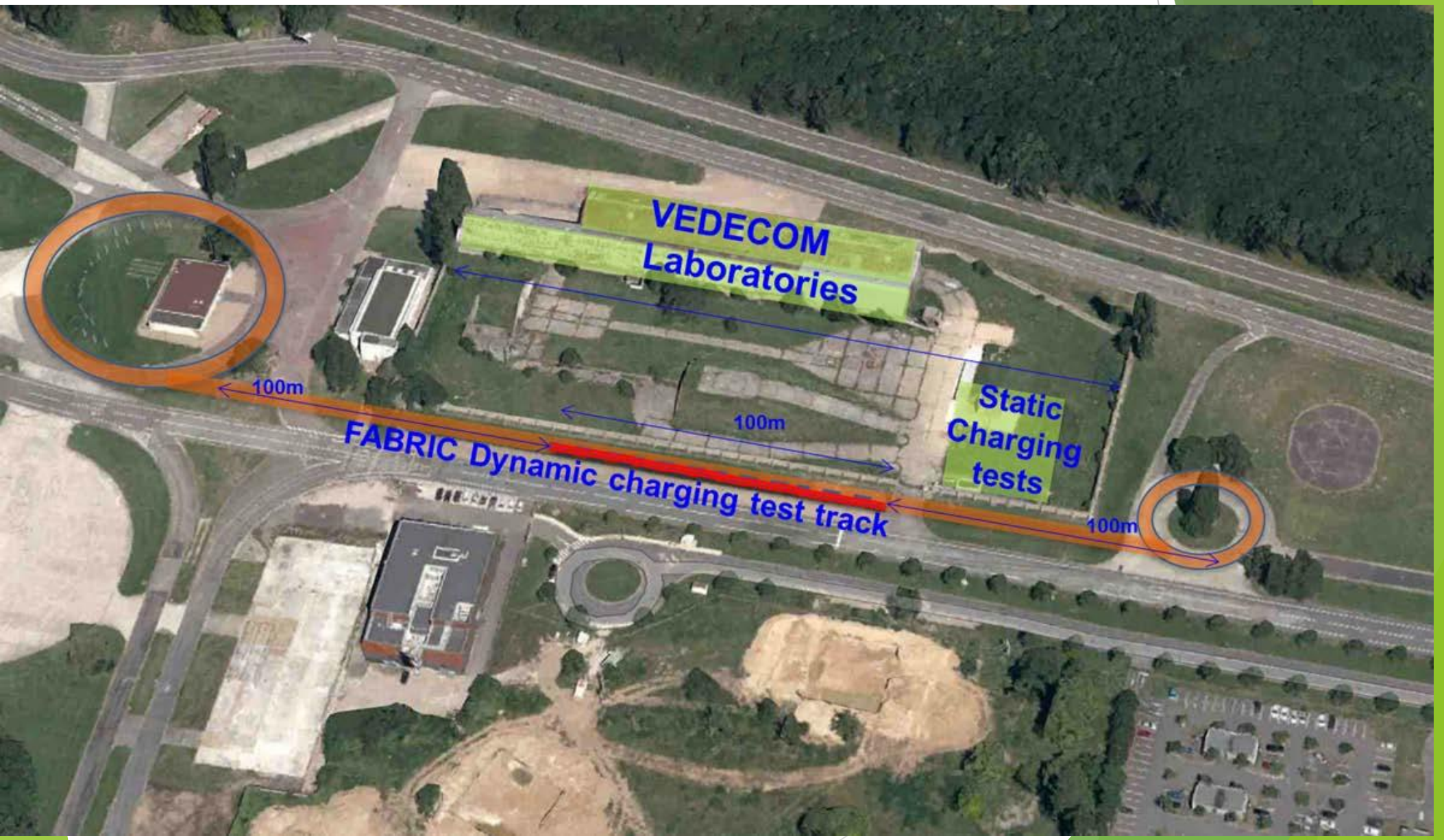
FABRIC timeline



FABRIC aims and achievements

- Road and grid infrastructure adaptations
- Development of vehicle prototypes
- Study of the Electromagnetic safety aspects
- Feasibility study of the large scale deployment of dynamic charging solutions and economic sustainability study
- Contribution to standards

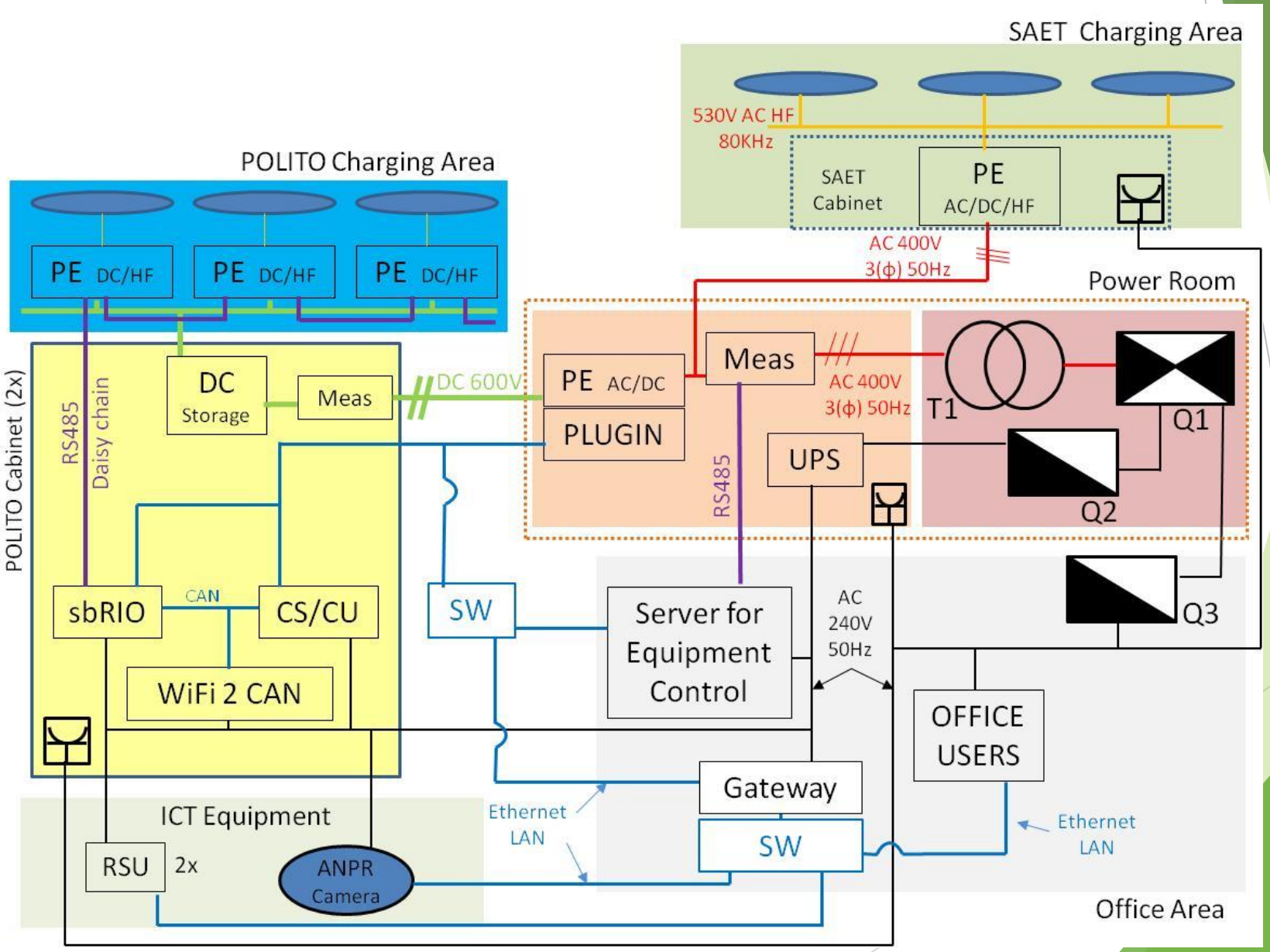
French Test Site (I)



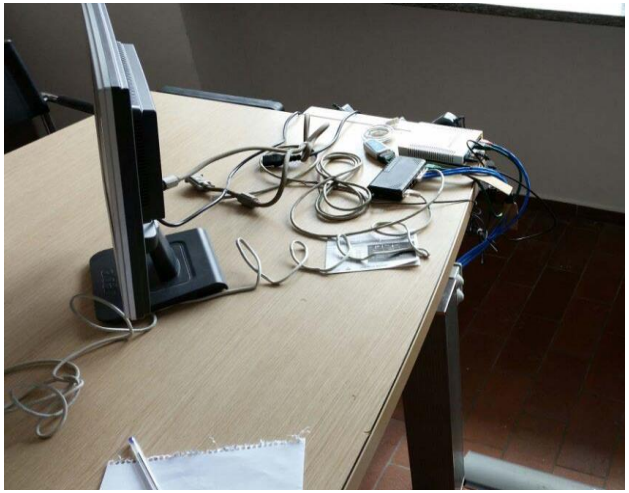
French Test Site (II)

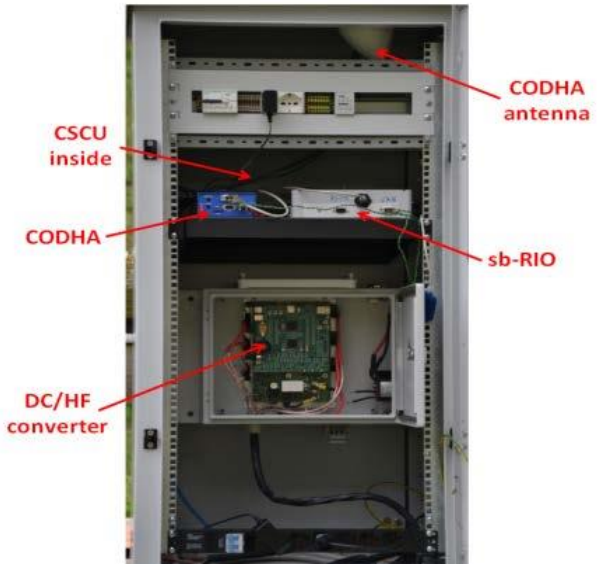
Italian Test Site (I)

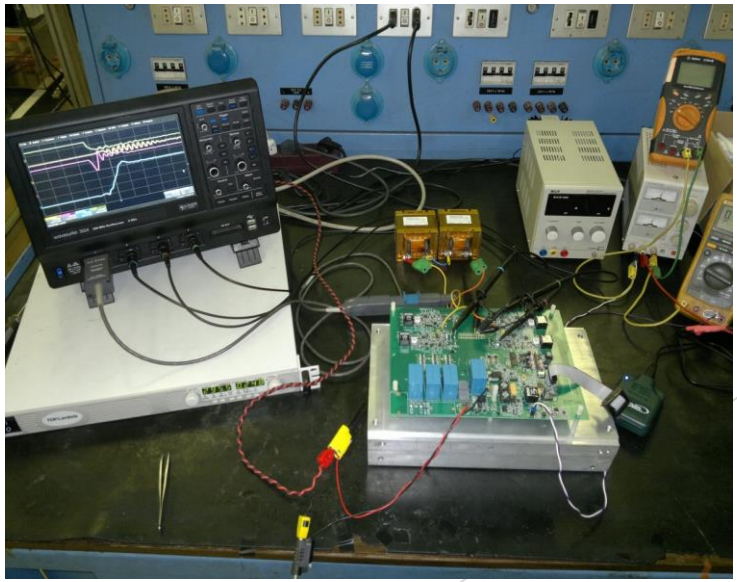
Italian Test Site (II)



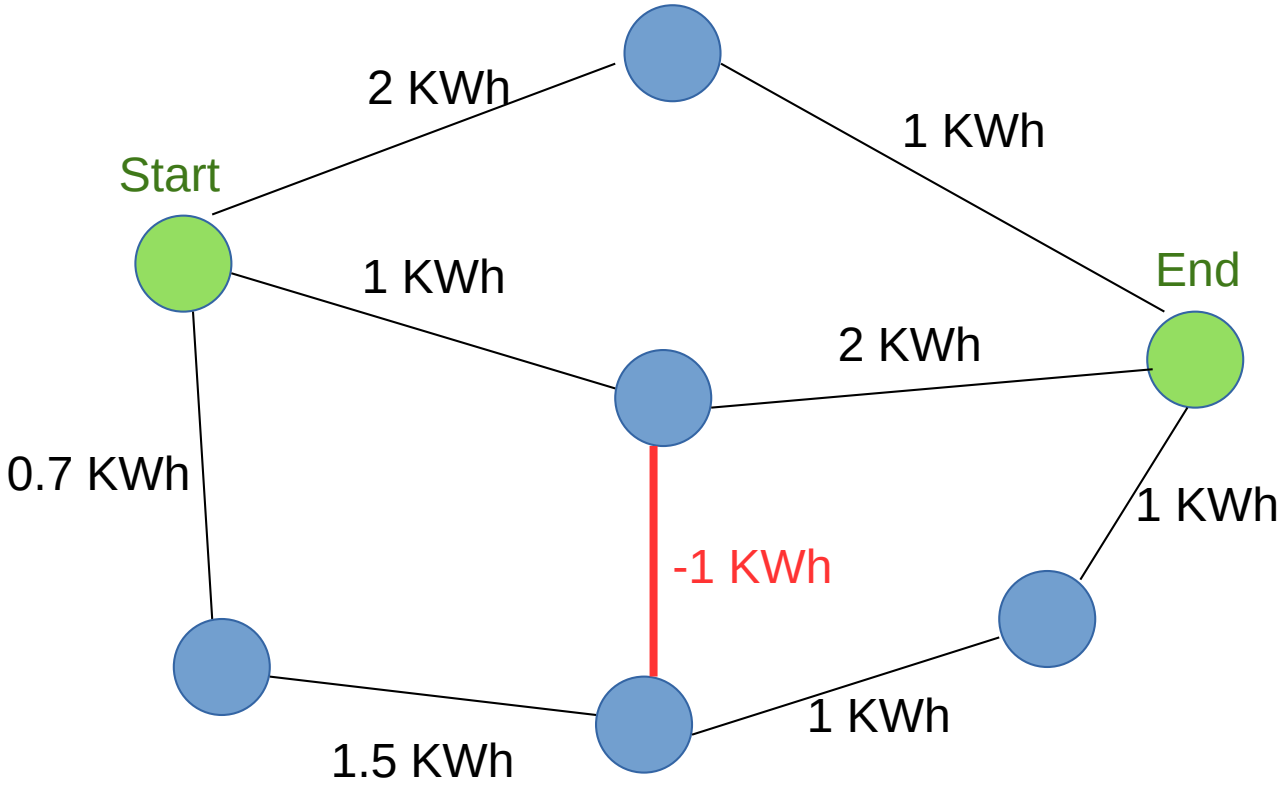
Italian Test Site (III)







Road Network with dynamic charging lanes

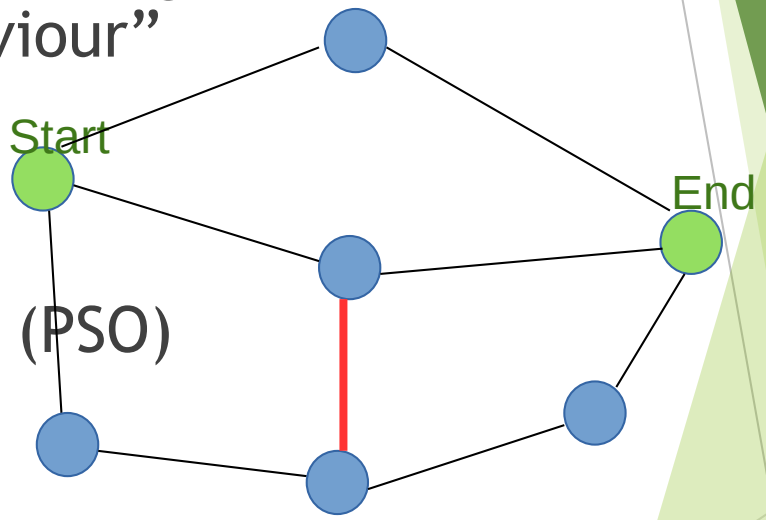


Routing algorithms

- Dijkstra, A*
- Bellman-Ford
- Ant colony Optimization, Particle swarm optimization

Swarm intelligence

- “Swarm intelligence is a property of systems of non-intelligent robots exhibiting collectively intelligent behaviour”



- Particle Swarm Oprimization (PSO)
  - Implementation in few lines
  - Few parameters to tune
  - Efficiency proven on embedded system
    - Suitable for installation on GPS navigation device

PSO algorithm

Initialise location and velocity of each particle

repeat

For each particle

evaluate objective function for each particle

For each particle

update best solution

update best global solution

For each particle

update the velocity

compute the new locations of the particles

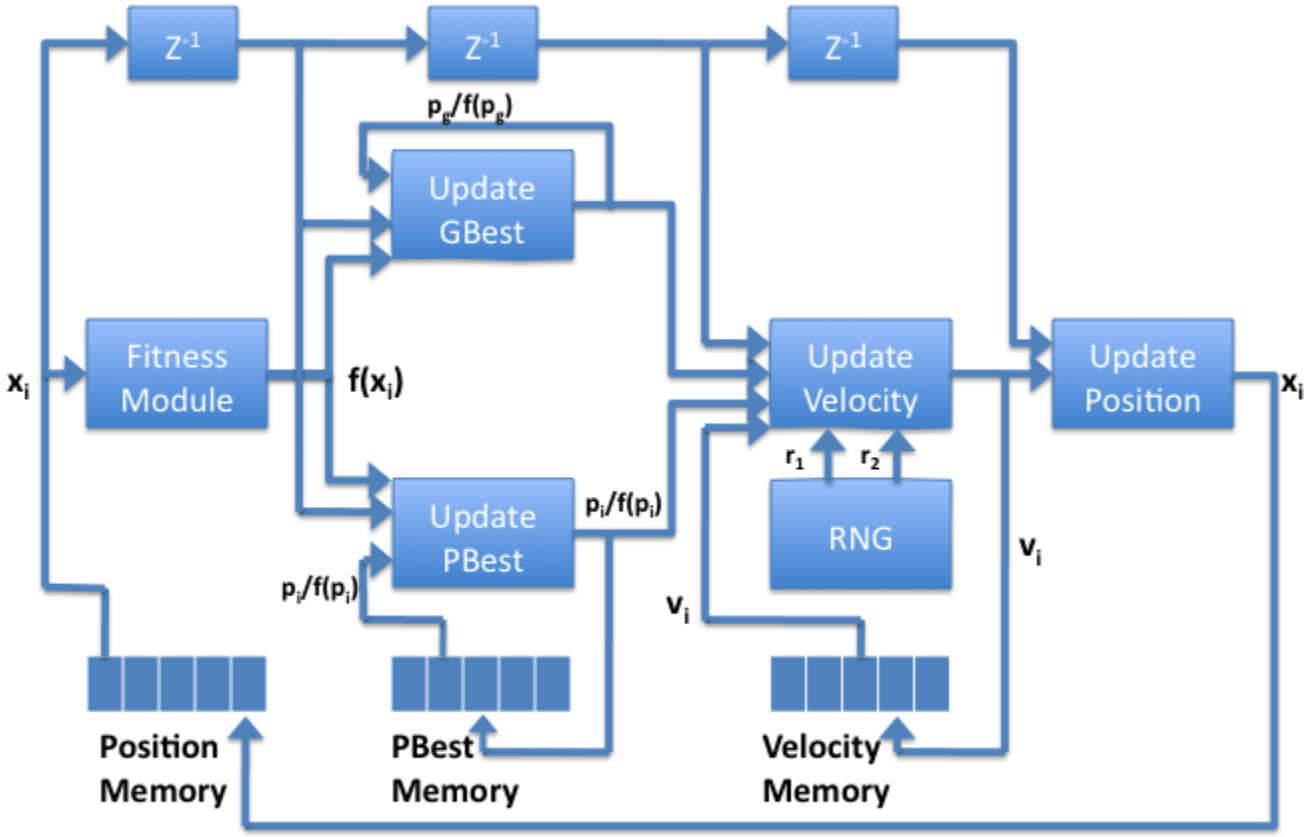
until finished()

Simulation

- MATSIM open source traffic simulator
- 10 dynamic charging Evs
- Battery capacity: from 11 to 20 KWh
- Road network
  - 15 nodes and 23 links
  - 283 Km
  - 95 km electrified lanes
- Power transfer: 15KW

- Initial SoC 16 Kwh (3)
- Travel distance between 50 and 160 km
- Dynamically charged energy 37 Kwh (10)
- Response time threshold: 1.5 seconds

Towards FPGA implementation



Conclusions and future work

- EV routing with dynamic charging
- PSO meta-euristic
- Simulation of realistic traffic
- Comparison with other routing algorithms
- Embedded hw implementation