



Feasibility analysis and development of on-road charging solutions for future electric vehicles

ICT needs and developments in FABRIC for on-road charging

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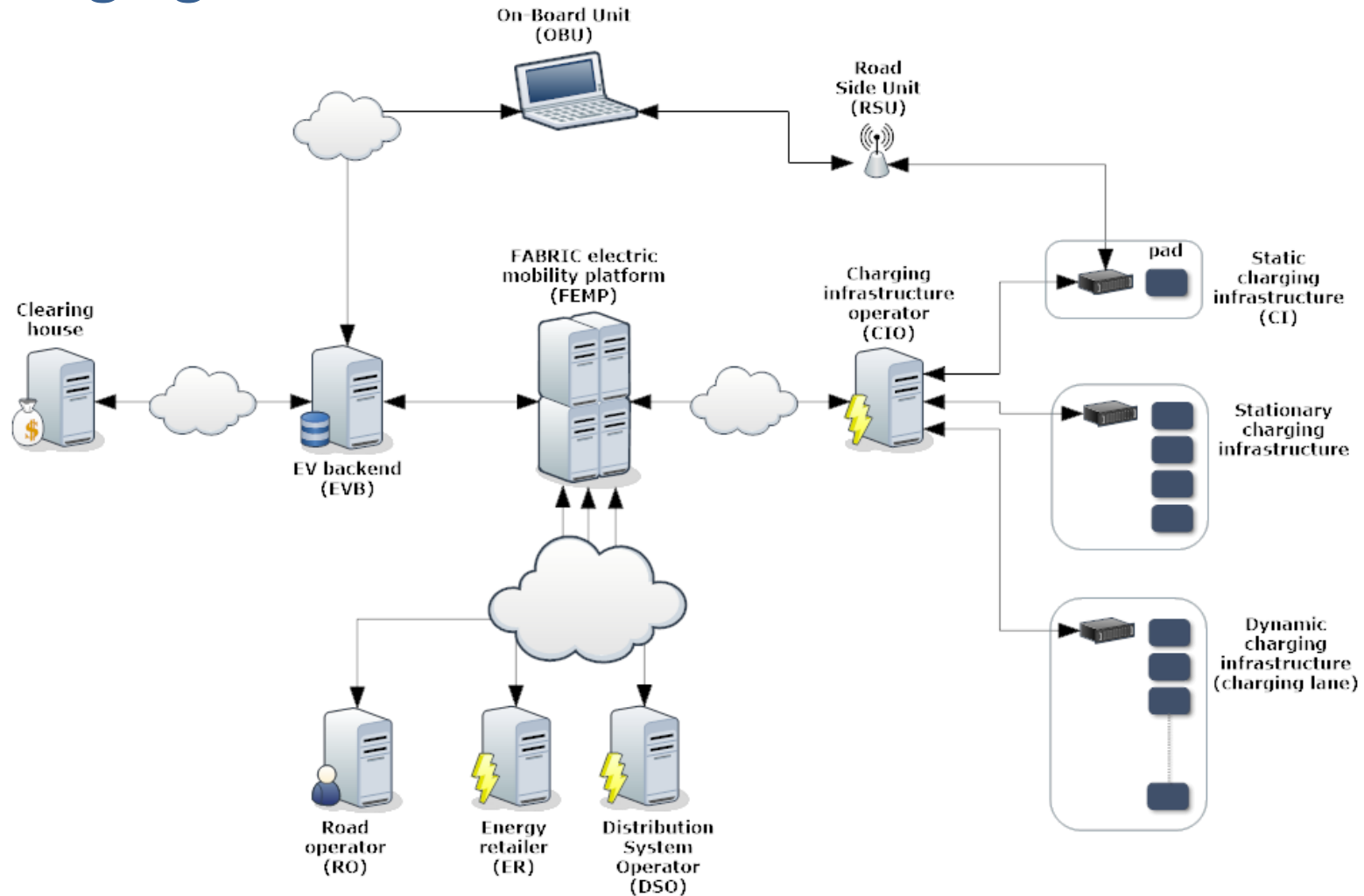


Overview

1. High level FABRIC ICT architecture for on-road charging
2. ICT needs and developments in FABRIC



High level FABRIC ICT architecture for on-road charging



Overview

1. High level ICT architecture for on-road charging
2. ICT needs and developments in FABRIC
 - User accounts, booking and billing
 - Dynamic routing for Electric Vehicles
 - Vehicle identification, charging lane access control and management/enforcement
 - ICT control of Wireless Power Transfer
 - Driving assistance while charging
 - Distribution Supply Operator (DSO) and grid management

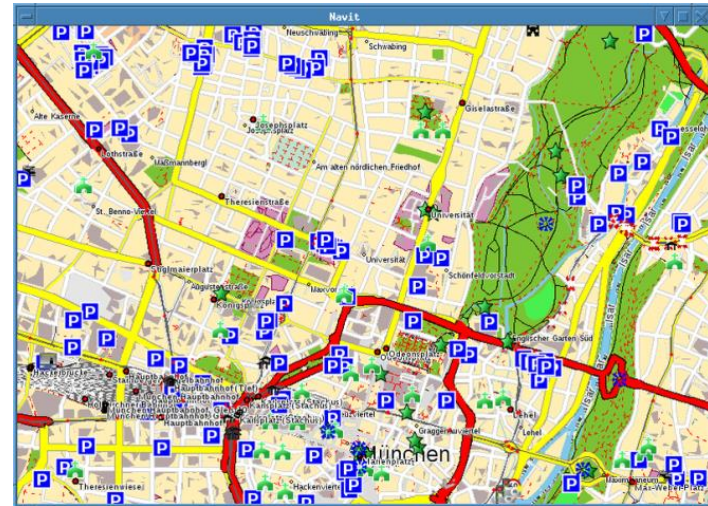
User accounts, booking and billing

- Driver needs to create an account to use the charging infrastructure, which uses a list of users to identify eligibility.
- Account should allow driver to use charging stations of different operators and in different countries.
- A booking system would enable charging station operator to meet demand, but there should be a mechanism to take into account delays in reaching the charging infrastructure.
- Billing process needs to take into account the difference between the transmitted energy and the energy that is actually received by the electric vehicle.



Dynamic routing for Electric Vehicles

- Itinerary choice
- Charging infrastructure location and availability
- Low charge warning and routing to closest charging infrastructure
- Charging location choice
- Trip timing
- Saving preferences
- State-of-the-art for EV navigation systems from several vehicle manufacturers: display places that can be reached within range; warn driver if not possible to reach destination; display characteristics of charging stations
- Existing navigation systems meet the essential requirements: itinerary choice, locating infrastructure, route calculation
- Future requirement: real-time availability and pricing information



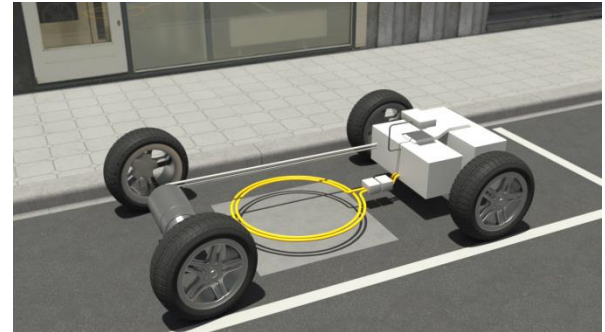
Vehicle identification, charging lane access control and management/enforcement

- Speed of identification & authorisation for dynamic charging should be much faster than for static charging
- Need a mechanism to take into account delays in reaching the charging infrastructure for booked vehicles
- Access to lane could be controlled, possibly with camera enforcement, or free access (all vehicles); the latter is proposed in FABRIC
- Physical configuration may depend on charging lane location (urban, motorway, etc.) and traffic speeds
- Detection can be by ANPR (Optical character recognition) or DSRC (v2i communication)
- Need standardisation of symbols on fixed and variable road signs to ensure understanding



ICT control of Wireless Power Transfer

- Smart metering:
 - may be energy transferred from the road (in which case off-vehicle metering would be required)
 - or energy received by the vehicle (on-board metering) – then needs to take account of energy loss
- Challenge for accurate metering: the higher the speeds and traffic densities, the more difficult it is to meter energy use accurately (affects billing)
- Emergency cut-off function, when energy transfer drops below a certain level of efficiency (due to driving behaviour or technical factors)



Driving assistance while charging

- Provision of information on approaching and activating charging, including pricing
- On-board unit: needs to minimise driver distraction
- Trajectory and speed advice (FABRIC did not look at automated driving, but this could be a future scenario)
- Prototype solutions developed and tested in France and Italy (see Grid Alignment Assistant System poster)



Distribution Supply Operator (DSO) and grid management

- To maintain distribution system balance, direct control strategies and intelligent distributed algorithms are needed
- Optimisation strategies can be formulated, e.g. based on energy supply availability: smart pricing schemes that enable demand shifting
- Load Balancing Algorithm developed and tested in simulation, to allow fair share for all vehicles using Dynamic Wireless Power Transfer (see Grid load balancing for DWPT poster)





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Thank you!

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