SMARTC²NET

UC Summary: Electrical Vehicle Charging in Low Voltage Grids

This use case describes the charging of electrical vehicles in a low voltage grid considering both public as well as private charging. The overall *objectives* of the use case are to provide EV charging service by:

• Satisfying the charging demands of *arriving* EVs in such a way that the charging load is distributed according to the resource capacities in time and space (geographical routing for public charging).

• Enabling electrical vehicle to charge flexibly, a feature that can be used by the local DSO to manage power quality control in the LV grid along with decentralized PV production as well as other loads (e.g. households), and by the EV aggregator to handle on the energy market.

• Providing a system architecture that enables interoperation between new actors such as charging station operator, the EV routing service provider, the EV aggregator, and existing actors such as DSOs and energy market.

• Enabling the DSOs to monitor the state of low voltage grid under EV load conditions.

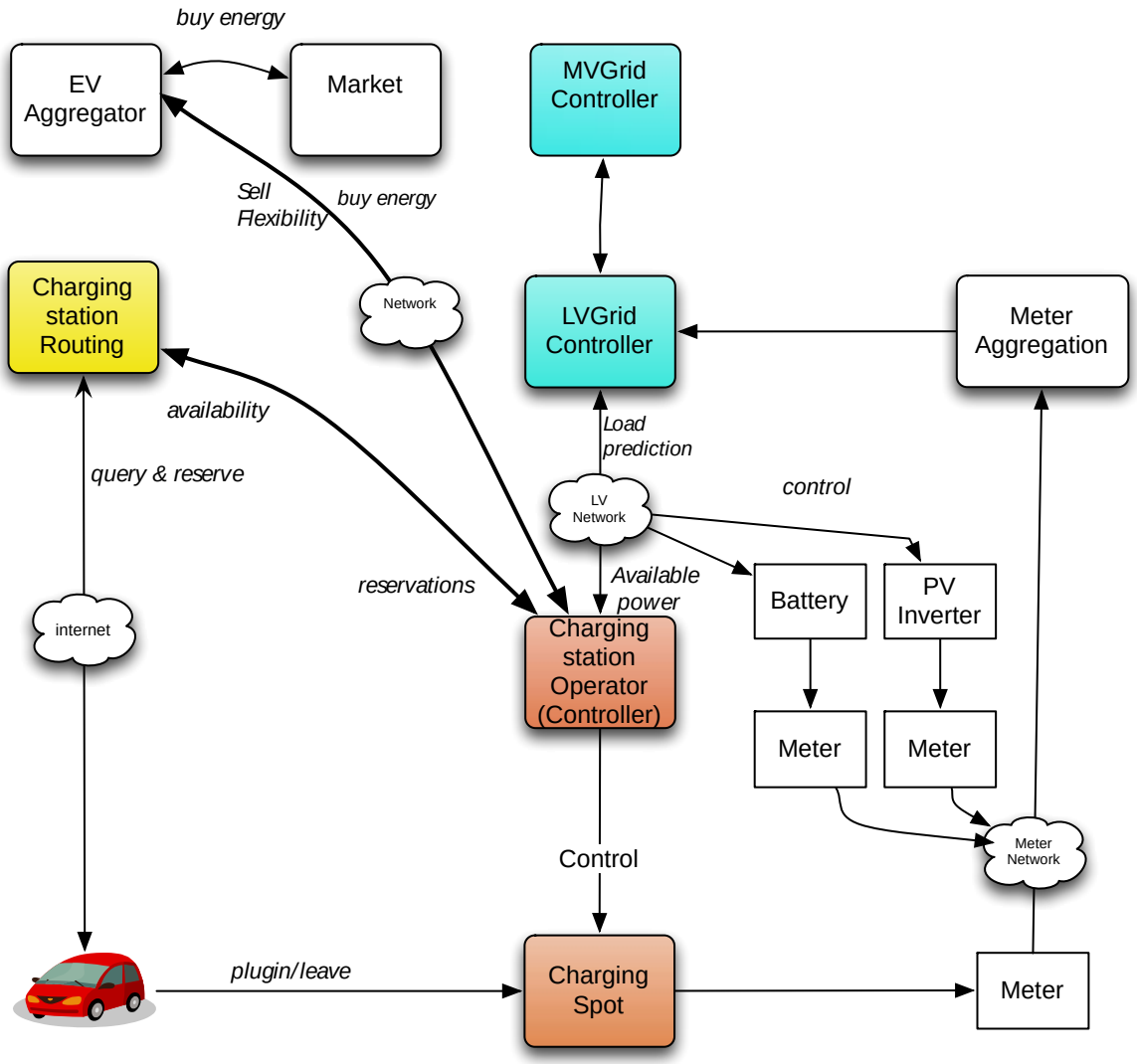
The EV charging scenarios described in this document cover the pre-charging scenario (not in detail) and the smart charging scenario (similar to CG-CG/M490 document, scenario WGSP-1300). The pre-charging interactions occur before arrival at the charging spot. The interaction of the EV with the Charging Station Operator (CSO) (mediated by a routing service) leads to a reservation and the allocation of a charging spot (CS), as well as the communication of desired charging demand, arrival time, leave time, etc. from the EV to the CSO. The CSO can already create a plan. Also without the pre-charge phase, the smart charging scenario is possible: the EV arrives at a free CS and requests the CSO to charge, while providing following data: arrival time (now), estimated departure time, minimum required amount of energy, maximum required amount of energy (to fill the battery), preferred charging speed (sub-scenario PS2). The CSO creates a schedule, based on *up-to-date* information: a) from the DSO about the charging capacity at that certain grid bus (available power), b) energy bought optimally on the market, following the offered (flexible) demand.

The use case also considers how the DSO can supervise the Low Voltage grid to observe potential power quality issues. The tool for the DSO to ensure power quality is a *low voltage grid controller* at the secondary sub-station providing the available power limitations and flexibility demands to the charging services. The low voltage grid controller utilizes the flexibility in conjunction with local power resources (battery and production) to actively control power quality.

A regional EV aggregator (or energy supplier) interacts with the market (retail and spot) and buys the EV charging energy according to the demand predicted by the charging stations. This demand is expressed specifying also the flexibility of the consumption, for which the charging station is rewarded. The aggregated requested EV demand cannot exceed the LV grid capacity (expressed by the available power).

Specific for SmartC2Net are the following communication failure sub-scenarios: in the first the communication channel from DSO to CSO for updating the available power is interrupted, implying a reduction of the charging duration or the intensity of all current operations, and in latter the metering data flow used for estimating the available power from the consumption and generation forecasts is disrupted. Due to this uncertainty, the calculated available power could be reduced for safe operation.

SMARTC²NET


buy energy
EV Aggregator
Market
MVGrid Controller
Sell Flexibility
buy energy
Charging station Routing
Network
LVGrid Controller
Meter Aggregation
availability
Load prediction
query & reserve
LV Network
control
reservations
Available power
Battery
PV Inverter
internet
Charging station Operator (Controller)
Meter
Meter
Meter Network
Control
plugin/leave
Charging Spot
Meter