EV charging:
a quick look under the AC covers

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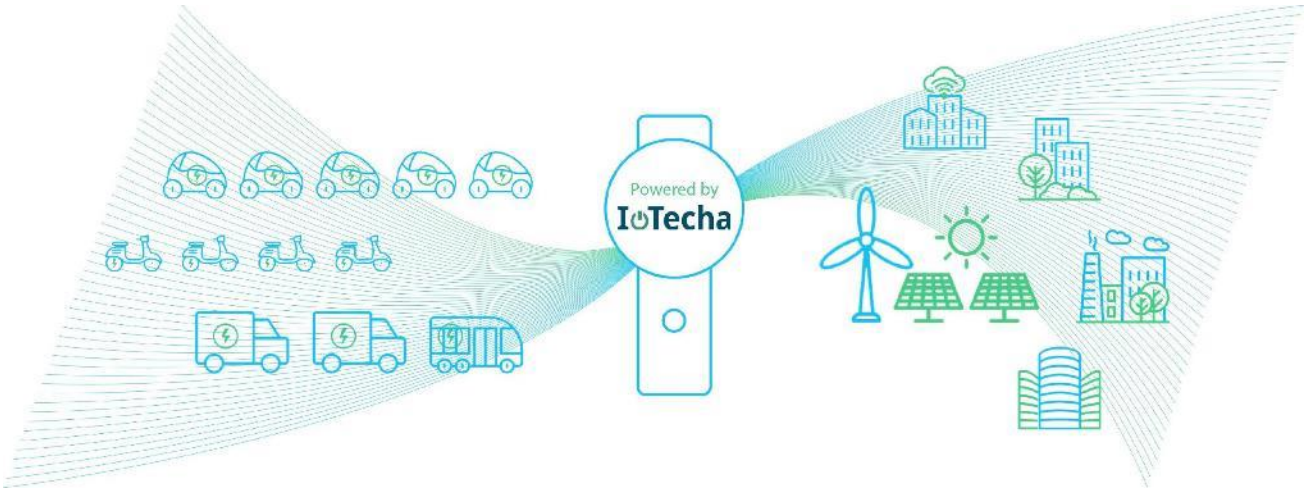
Outline

- Who & What
- AC Charging/Charger Anatomy
- Smart charging
- Engineering DNA
- V2G/V2X
- EV Charging Data-Sphere

Who: IoTecha Background



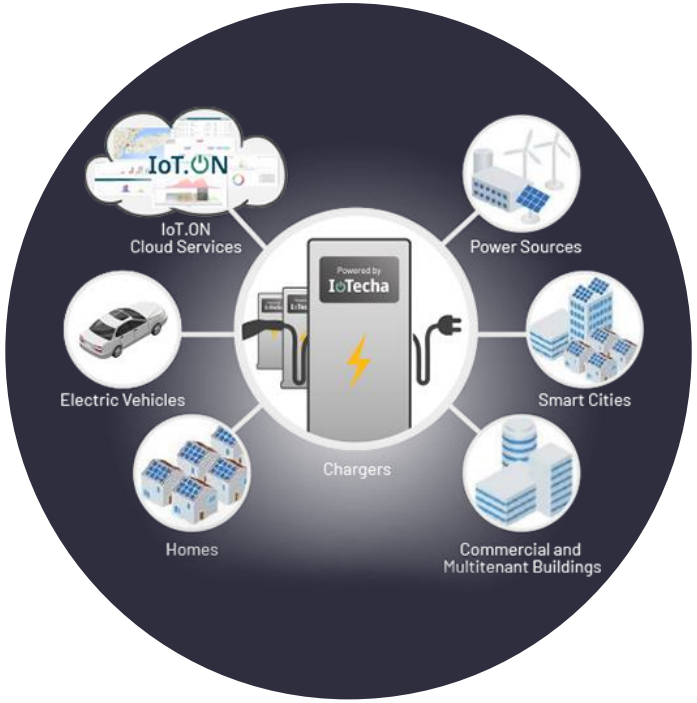
IoTecha accelerates the Electric Vehicle Revolution by providing the **most comprehensive platform for Smart Charging infrastructure**, enabling integration of tens of millions of Electric Vehicles with the Power Grid.

- IoTecha was launched in 2016
- Our main customers are:
  - Automotive OEMs
  - Infrastructure OEMs
  - Charge Point Operators (CPO)
  - Energy companies
  - Electric utilities and distribution companies
- Our products and services implement the latest and most widely adopted standards including Combined Charging System with ISO/IEC 15118
- Founding members of the team are also co-inventors of HomePlug Powerline Communication (HPGP)

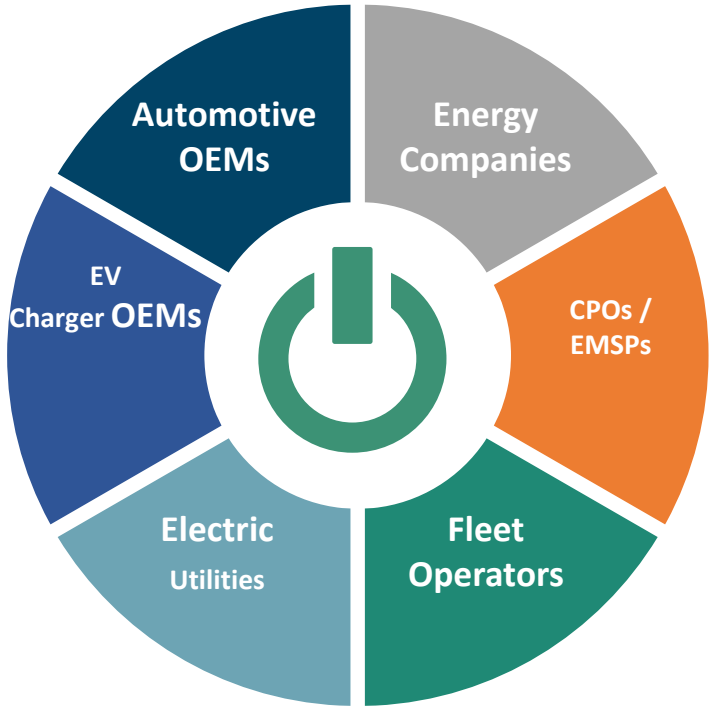
What: Platform Technologies

IoTecha provides a platform of products and services that accelerate the deployment of the Smart EV Charging Infrastructure

EV Smart Charging Hardware and Services



Key Supplier to Broad Range of Industries



Commercialized in-market presence

Successful Products and Services

- The first ISO/IEC 15118 PnC 80A charger in the North America market
- Charging Controller for the first 800V DC Charger
- Industry-leading Protocol Analyzer

Blue-Chip Customers

- Tier 1 supplier of white labeled charging stations and cloud-based services for numerous EV OEMs and Charger OEMs

https://www.newswire.ca/news-releases/porsche-destination-charging-expands-network-in-canada-837302087.html

"IoTecha is at the forefront of the trend towards electrification, and their unique technology combines EV charging with smart connectivity to deliver cost and energy savings."

- Richard Bartlett, SVP future mobility & solutions, BP

UK Market

- Today:
  - 37 million ICE cars/vans
  - 570,000 BEV (~1 million plug-ins)
  - 35,000 public chargers
  - Dynamic: BEV sales 17% of market
- 2030:
  - 10 million BEV
  - 300,000 public chargers
- AC charging est. 80%+
  - Segmented - residential, office, fleet, public

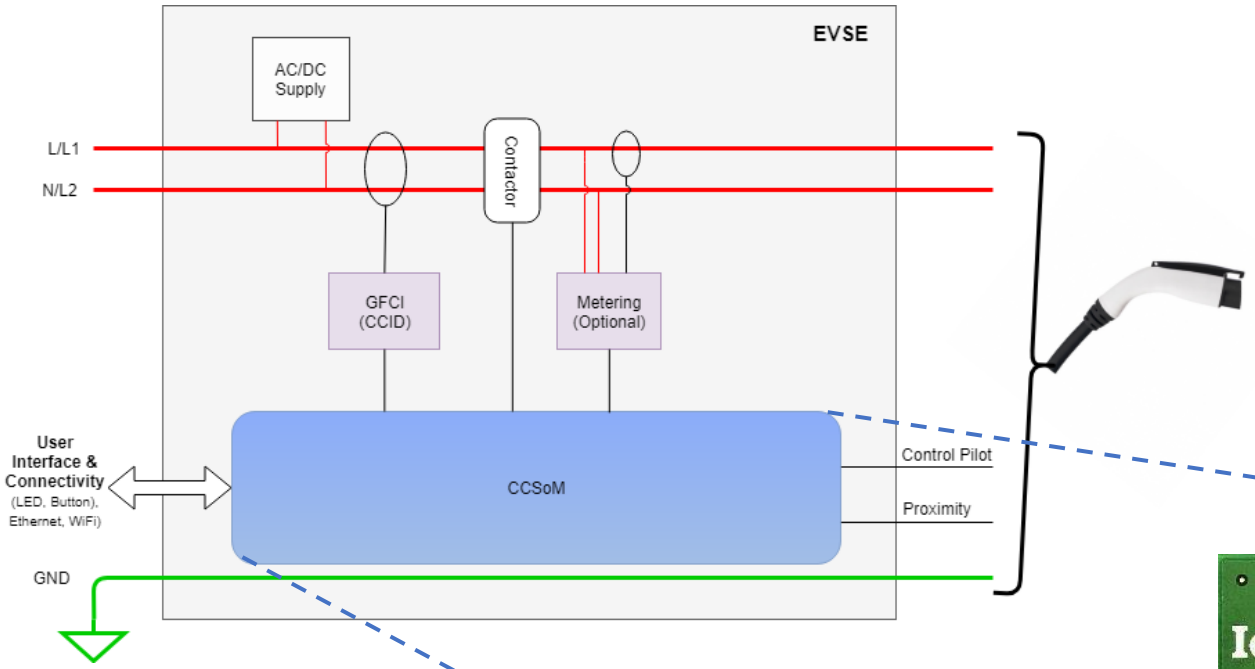
The UK market: In 2022, the UK is a leader in the EV transition and in many aspects of charging infrastructure provision. There are around 29,600 public chargepoints in the UK of which over 5,400 are 'rapid' – able to charge an EV in around 30 minutes.[3] This infrastructure is serving around 750,000 plug-in vehicles (of which over half are pure battery electric).[4] These numbers compare well to the 8,000 or so UK petrol stations (with around 66,000 spaces at pumps) currently serving around 37 million petrol and diesel vehicles.[5,6]

- HMG report: taking-charge-the-electric-vehicle-infrastructure-strategy.pdf
- See Zap-map market statistics

AC Charging

- Legislation and energy economics driving adoption of Electric Vehicles
- EV sales and demand for energy set to continue (CAGR 25% min)
- Typically, 1-phase (3.6kW/7kW), 3-phase 22kW
- Economies of scale => modular, multi-domain platforms
- Embryonic and evolving regulation

Anatomy of AC EVSE



CCSoM

EVSE = Charger
CCSoM = IoTecha CCSoM Module

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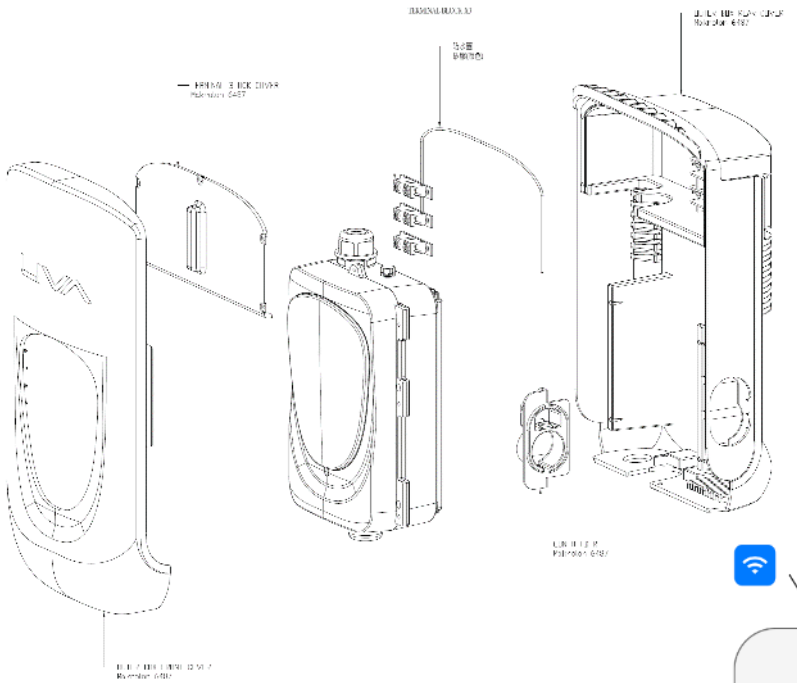
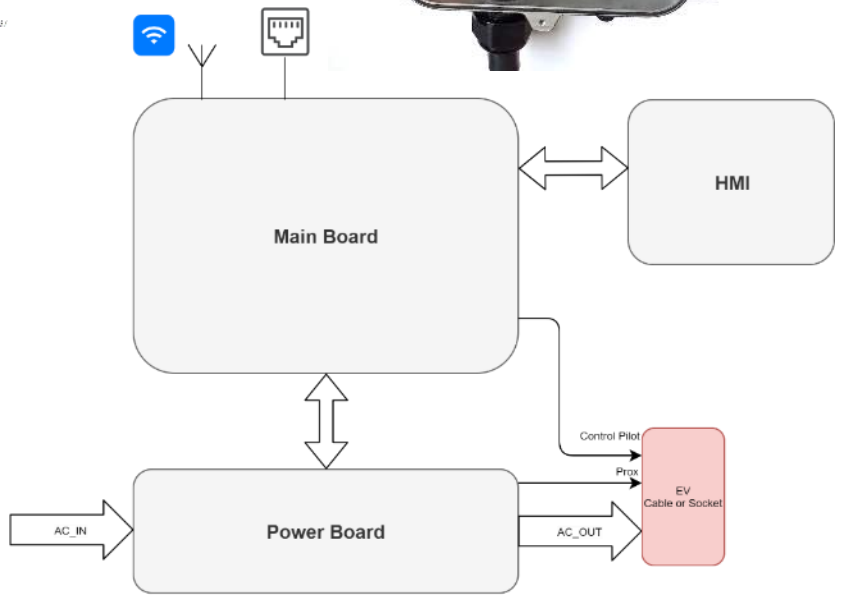
Modular AC Charger





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End-to-End View of EV Charging Machinery

Root-Certificate Authority (“Root CA”) Ecosystem

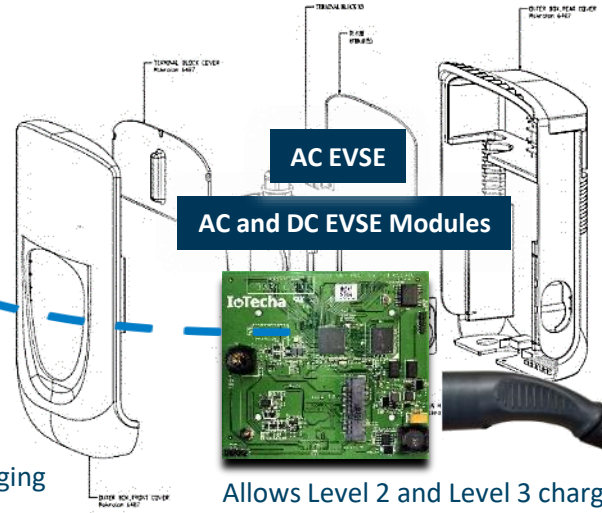
- Digital certificate that belongs to the issuing Certificate Authority
- Enables Plug-In-Charge and account authentication
- Creates ease of use

IoT.ON™ Cloud

- Offers IoT device monitoring, remote troubleshooting, maintenance, and firmware updates
- Offers Vehicle Grid Integration (VGI), Vehicle to Grid (V2G), and intelligent charging orchestration services
- Value added services including advertising

IoT.ON™ Edge

Enables customers to monitor charging infrastructure (across all sites and geographies) and orchestrate energy flows to and from their EV chargers



AC EVSE

AC and DC EVSE Modules

Allows Level 2 and Level 3 charger manufacturers to shorten their time to market and reduce their development efforts while producing an intelligent charger

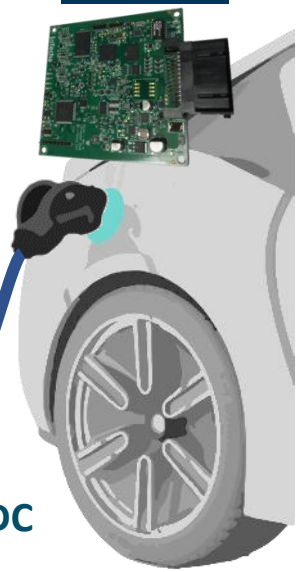
Enables in-depth analysis of Vehicle-to-Grid (“V2G”) communication using packet capturing and protocol analysis

V2G Protocol Analyzer

PilotShark

Version of Combined Charging System on Module (“CCSOM”) for the installation in electric vehicles

EV Module



AC or DC

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Charging Infrastructure Must Be “Smart”

To meet growing market needs and integrate with the power grid, Charging Infrastructure must be:

1 Connected

- Ability to **connect to wide range and types of networks**
- Ability to **remotely perform firmware updates, maintenance, and troubleshooting**
- Ability to **access data** to enable decision making

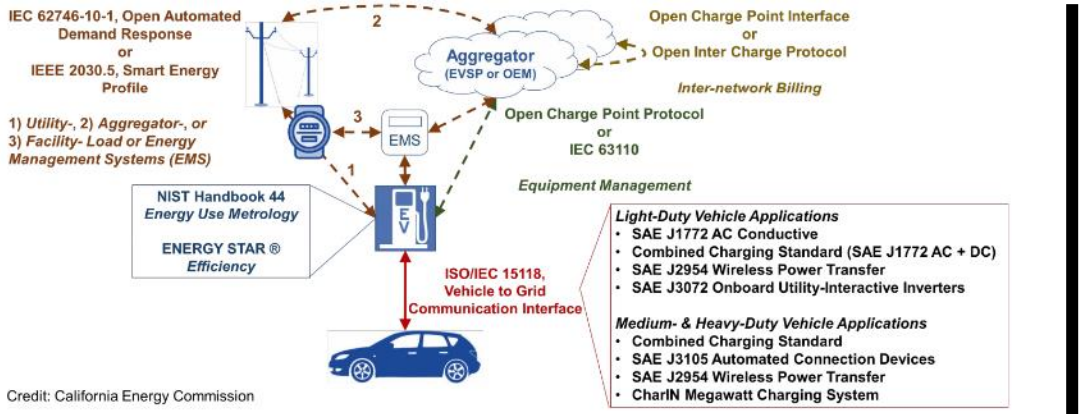
2 Intelligent

- **Adapting the way that EVs charge** to the needs of consumers/businesses and capabilities of power grids
- **Optimizing charging costs and grid efficiency** based on many factors, including consumer & business needs, **demand for and availability of power**, **bi-directional charging**, and **share of renewable energy** in the supply profile

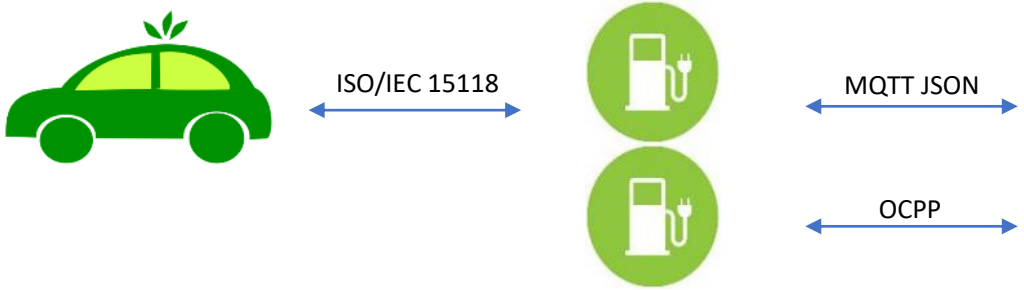
3 Interoperable

- EVs and EVSEs produced by different vendors **must seamlessly work together**
- **Compatibility** across the key system components: vehicles, charging stations, charging networks, and the grid

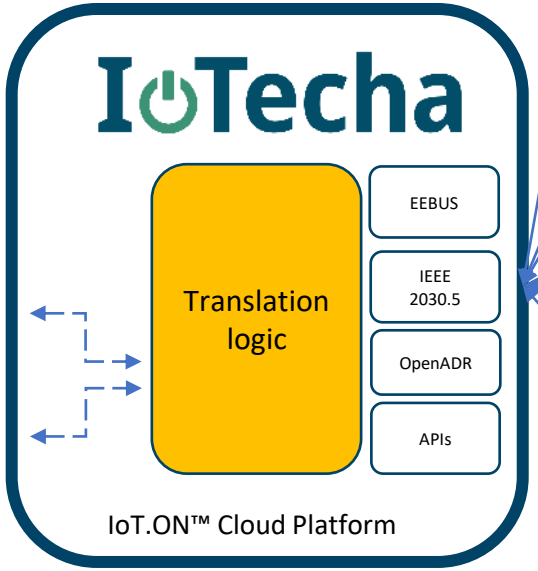
Next: V2X/V2G - Integration with Grid & Grid services

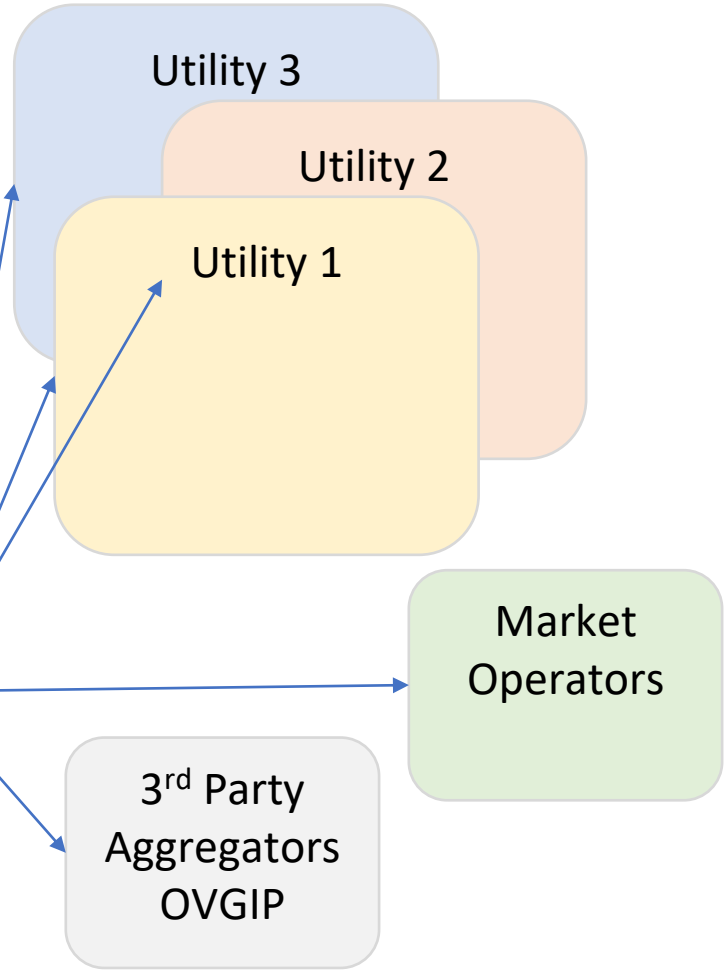


VGI communications mapping (AB2127 staff assessment report)



IoTecha's VGI Platform





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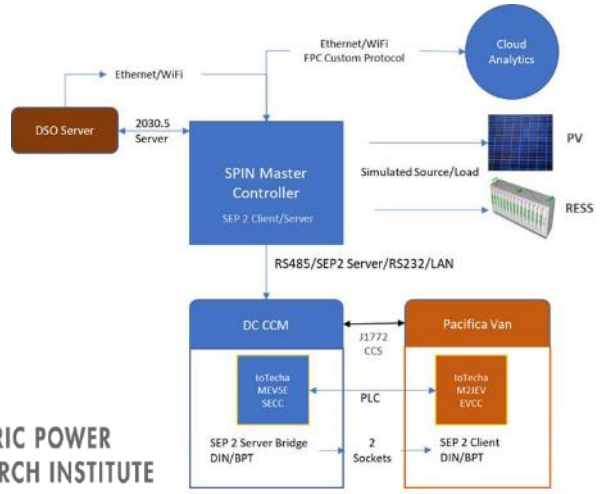
Examples

1



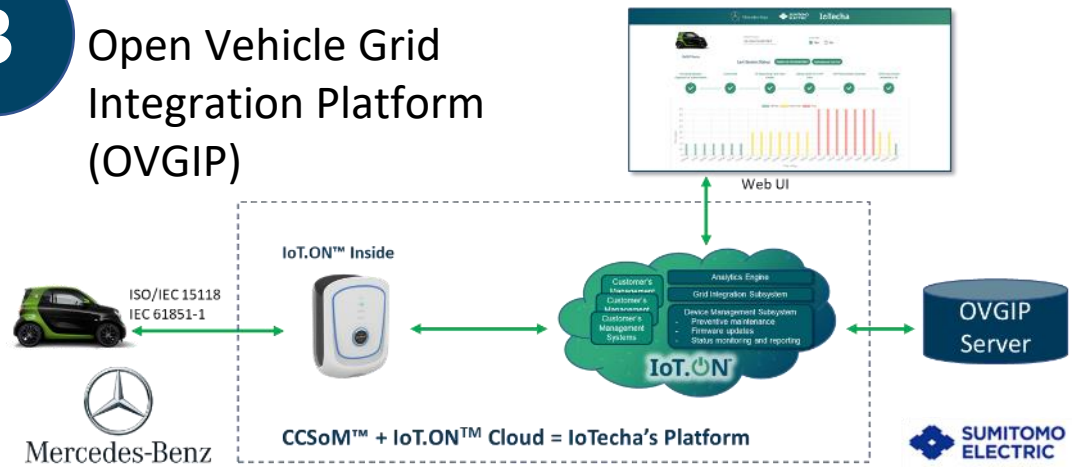
EPRI ELECTRIC POWER RESEARCH INSTITUTE

2

Bi-Directional DC Charging and V2G for HD and Bus Fleets

3

Open Vehicle Grid Integration Platform (OVGIP)



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EV Charging Data-Sphere